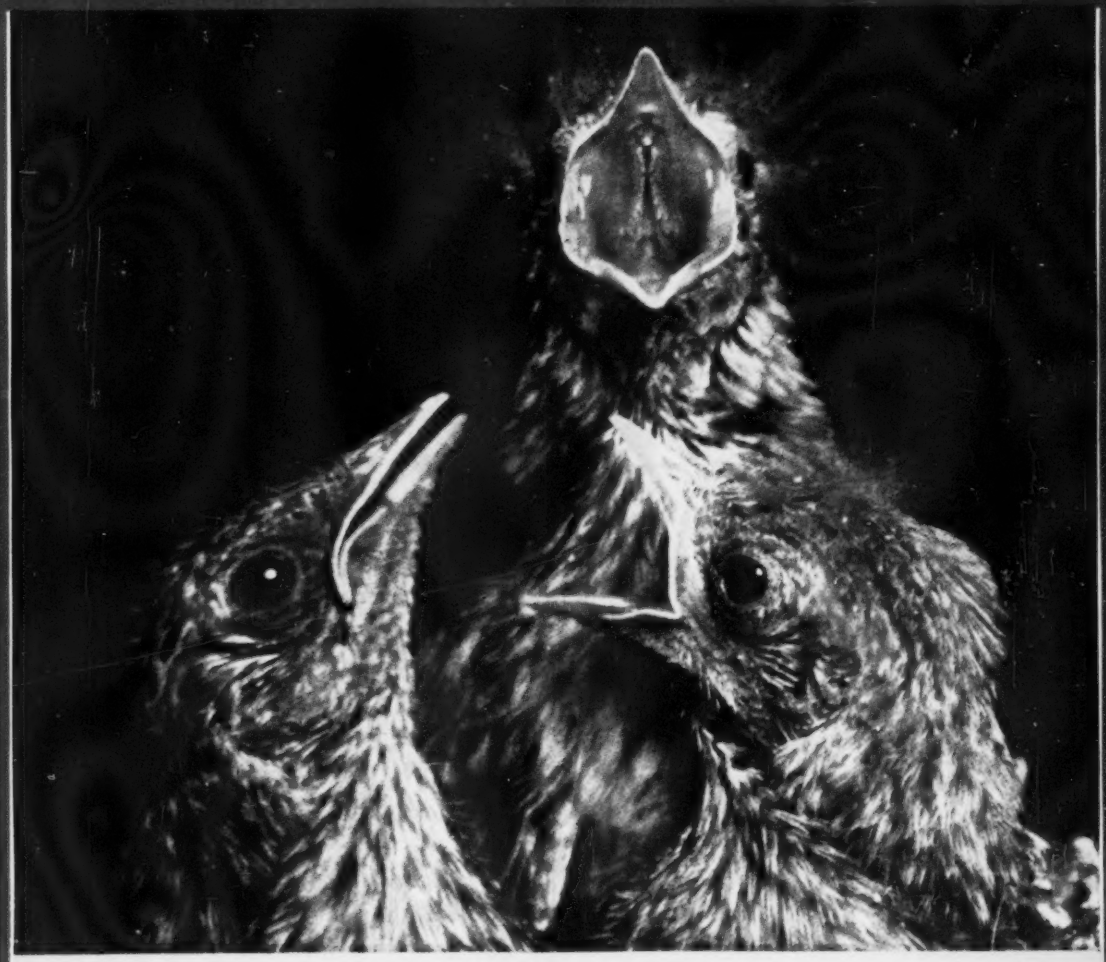
22 DECEMBER 1961

METAL INDUSTRY

THE JOURNAL OF NON-FERROUS METALS



DOING WHAT COMES NATURALLY

Baby birds just naturally expect the right food to be dropped into their beaks; and when engineers specify Platt's non-ferrous metals, they are just as confident that they will receive exactly what they need. Platt's themselves are like the mother-bird—doing what comes naturally—by giving you consistent purity and meticulous specifications, in the production of **brass, bronze, gunmetal, zinc and lead alloys.** Ask Platt to quote you. Their keen prices may well surprise you.

Platt PM
METALS LTD
ENFIELD MIDDX · HOWARD 3351

VOL 99 No 25 ONE SHILLING

For the convenience of our Scottish customers a branch has been opened in Glasgow with full Laboratory and Technical service.

Polishing and plating materials, lacquers etc., are available from stock.

Head Office :
Gt. Hampton St.
Birmingham 18.
Also at : London, Sheffield & Assoc. Co. in Australia.

Consult

INTERNATIONAL REFINING CO., LTD.

for prices prior to disposal of your Non-Ferrous Metal Scrap and Residues, whether clean or irony.

Consult

Maryland Alloys Ltd.

for your requirements of Non-Ferrous Metal Ingots, whether of commercial or complex specifications.

Consult

Non-Ferrous Stockholders Ltd.

for your requirements of Sheets, Strips, Rods, Bars, Sections, in Aluminium and Alloys, Brass, etc., whether for immediate or long-term requirements.

Consult

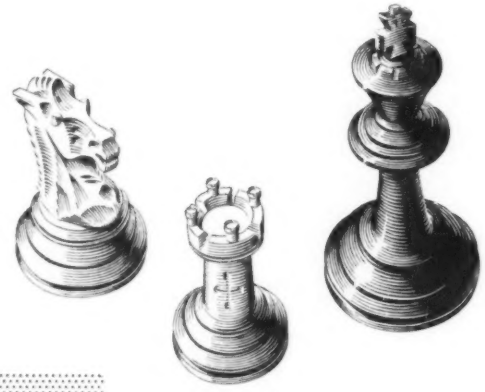
Alloy & Metal Stockholders Ltd.

for your requirements in Steel Sheets, Rods, R.S.J.'s, Plates, etc., whether from our extensive stock or for future requirements.

HEAD OFFICE and WORKS
20/22 SUGAR HOUSE LANE, LONDON, E.15
Tel: MARyland 7771 (5 lines) LONDON TELEX No. 2-3514

BIRMINGHAM
LANCASTER COPPER WORKS, 87-95 LANCASTER ST., B'HAM, 4
Tel: ASTon Cross 1982 P.B.X.

MANCHESTER
26, LYNTHORPE ROAD, NEW MOSTON, MANCHESTER 10



a real teaser

If there seems to be no way out of your particular problems call in the company with unequalled design and production experience in sheet metal fabrication and assembly

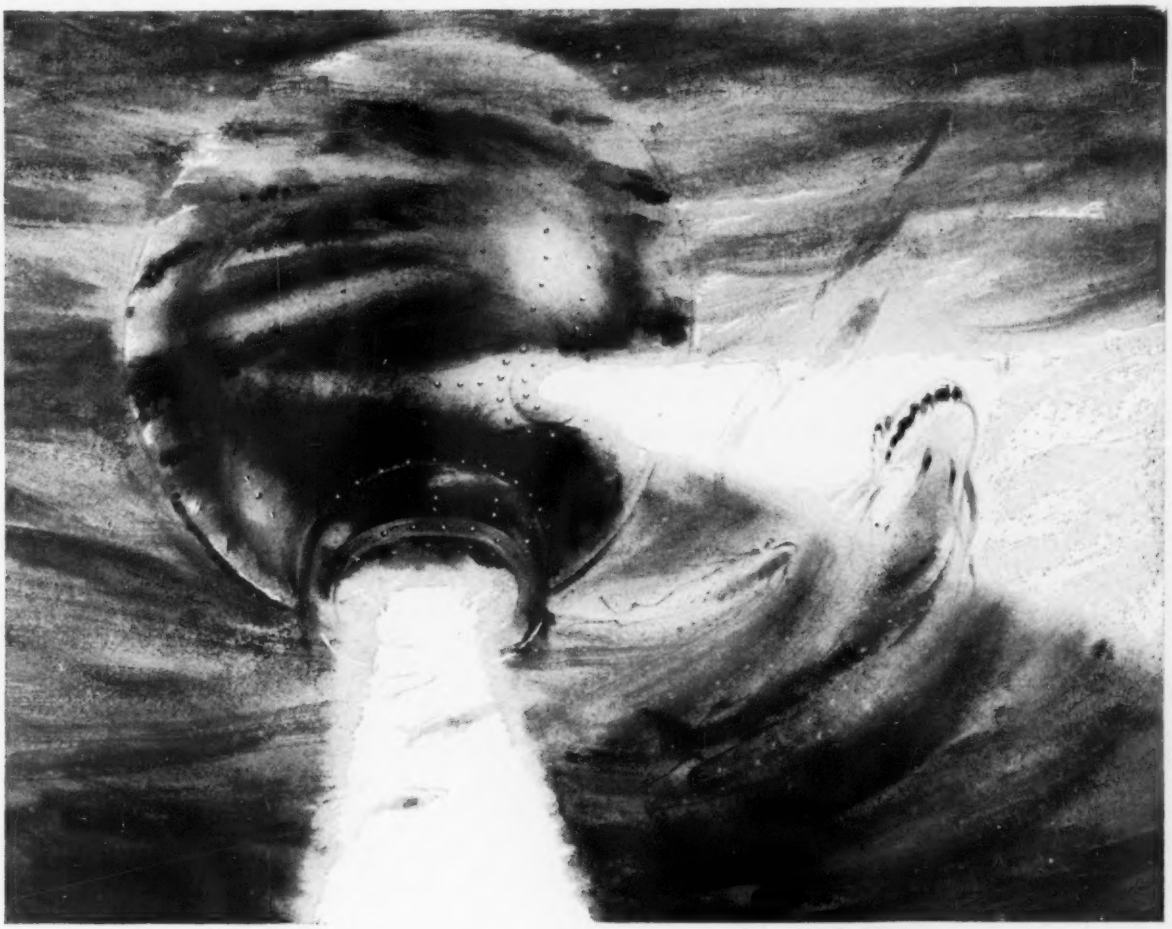
Specialists in design and complete unit production.

Camelinat

E. CAMELINAT & CO. LTD.,
CARVER STREET, BIRMINGHAM, 1
Phone: CENtral 6755 (5 lines)
Grams: Camelinat, B'ham.

Member of the Owen Organisation

SM/EC 3837



PERFECTION GOES DEEP

Perfection in technical achievement is everywhere sought with diligence and patience. The sources of its achievement, if achievement be possible, lie deep . . . deep in the seas of accumulated experience, knowledge and craftsmanship. We make no claim to have plumbed the final depths but we do say with complete conviction that our continuous pursuit of the objective more than maintains a long standing leadership.

For the production of non-ferrous ingots to B.S.S. or any special analysis you may be sure of . . . . . .

Park and Paterson Ltd.

INGOT MANUFACTURERS
ESTABLISHED 1872

MANCHESTER
MARPLE, STOCKPORT, CHESHIRE. *Telephone:* MARPLE 1422-3

GLASGOW
PARKHEAD, GLASGOW, E.1. *Telephone:* BRIDGETON 4451-2

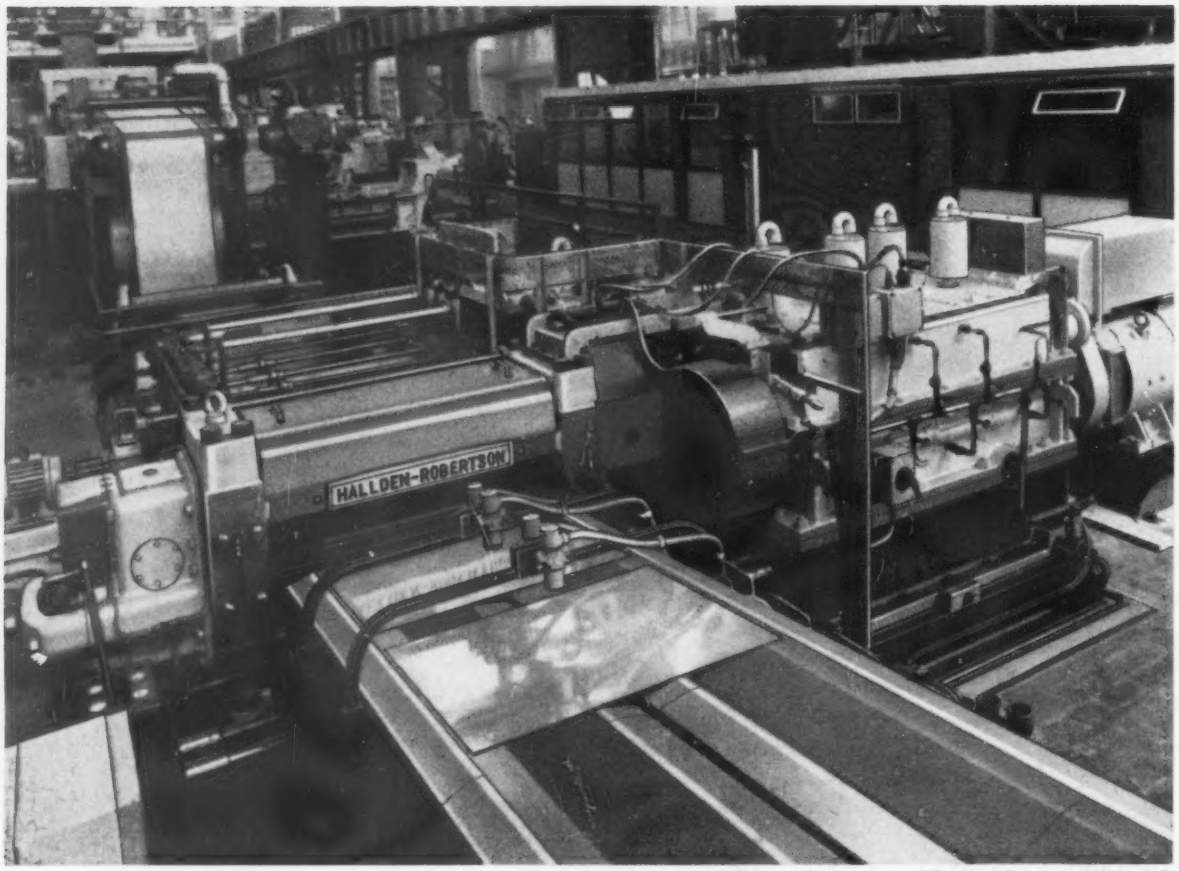
A

ROBERTSON

HALLDEN ROTARY TIN-PLATE SHEARS

BUILT BY ROBERTSON

are included in the three electrolytic tinning lines installed at the Velindre Works of the Steel Company of Wales Ltd.



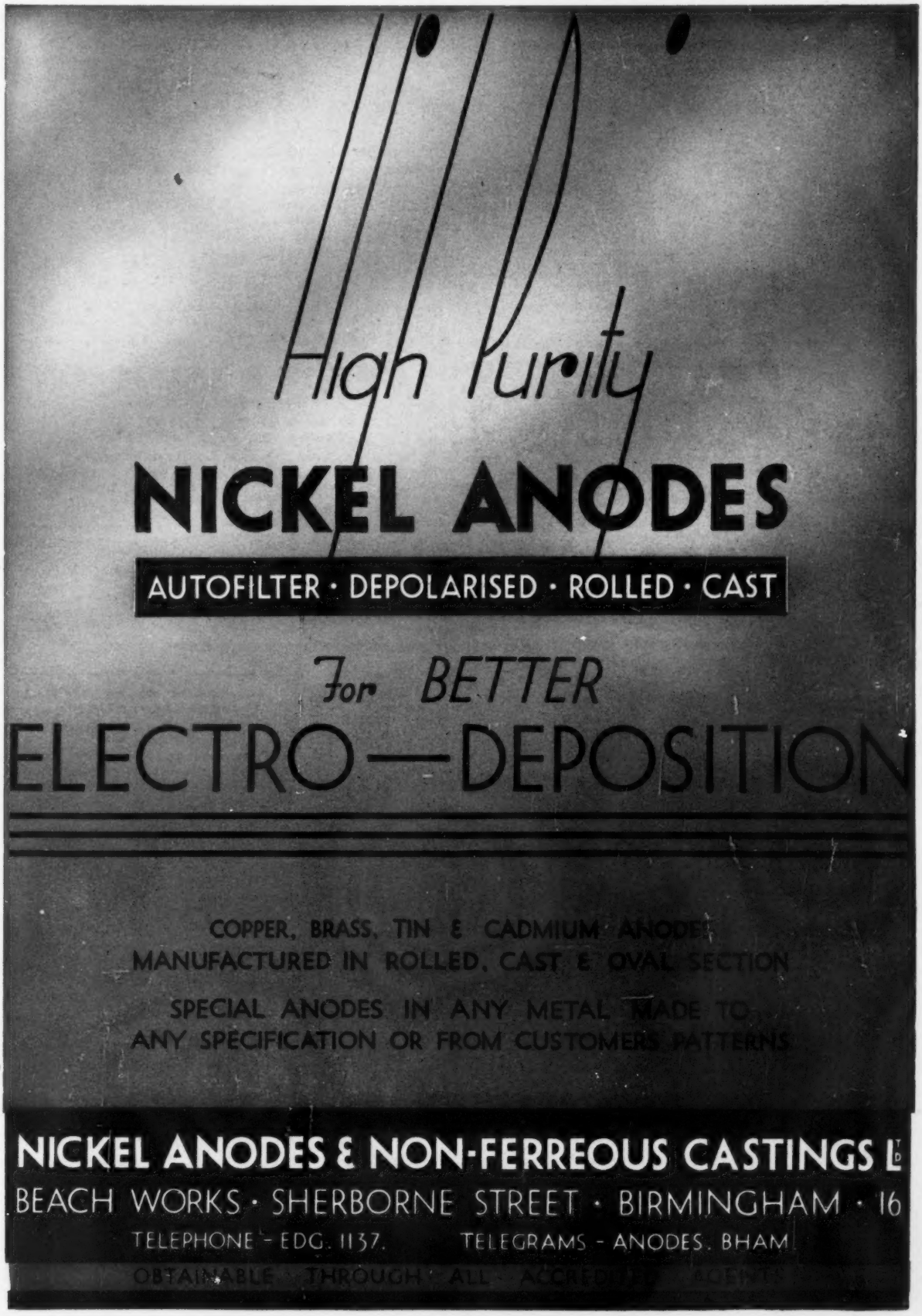
Photograph by courtesy of The Steel Company of Wales Ltd.

The three Cut-up Lines fitted with this Hallden design machine are capable of dealing with all tin-plate gauges and sheet sizes up to a rate of 428 sheets per minute.

W. H. A. ROBERTSON & CO. LTD.
BEDFORD • ENGLAND

LICENSEES FOR THE BUILDING OF SENDZIMIR COLD REDUCTION MILLS AND PLANETARY HOT MILLS AND HALLDEN FLYING SHEARS

WT.3195


High Purity
NICKEL ANODES
AUTOFILTER · DEPOLARISED · ROLLED · CAST
For BETTER
ELECTRO—DEPOSITION
COPPER, BRASS, TIN & CADMIUM ANODES
MANUFACTURED IN ROLLED, CAST & OVAL SECTION
SPECIAL ANODES IN ANY METAL MADE TO
ANY SPECIFICATION OR FROM CUSTOMERS PATTERNS
NICKEL ANODES & NON-FERREOUS CASTINGS LTD
BEACH WORKS · SHERBORNE STREET · BIRMINGHAM · 16
TELEPHONE - EDG. 1137. TELEGRAMS - ANODES. BHAM
OBTAINABLE THROUGH ALL ACCREDITED AGENTS

Sign of RS *Service*

ANODISING

A.I.D., A.R.B., and I.A. Approved

CHROMIC and SULPHURIC ACID PROCESSES
DECORATIVE SILVER ANODISING work of exceptionally long dimensions — A SPECIALITY
24-hour service on repetition work. Free collection and delivery.
ELECTRO-PLATING in Chrome, Nickel, Copper, Cadmium, Zinc, Silver, etc. Chromating, Phosphating & all other processes.
STOVE ENAMELLING. Cellulose Paint Spraying & Sand Blasting.

ROBERT STUART (LONDON) LTD.

ASCHAM STREET, KENTISH TOWN, LONDON, N.W.5 • TEL: GULLIVER 6141 (6 lines)

ALUMINIUM ALLOY INGOTS

TO ALL SPECIFICATIONS
ILFAR ALUMINIUM Co. Ltd
CANLEY, COVENTRY — Phone 3671

GORDON SIMPSON

(ASSAYER) LIMITED
ANALYTICAL CHEMISTS
ASSAYERS AND SAMPLERS
On Metal Exchange List of Assayers and Samplers
LABORATORIES AND ASSAY OFFICES
191 CLAPHAM ROAD, LONDON, S.W.9
Phone: BRixton 1671

Metal Finishers

HARD CHROME
HEAVY NICKEL DEPOSITION
BARREL PLATING

Firma CHROME PLATING CO. LTD.
66-72 EYRE STREET, SHEFFIELD, 1.
Telephone: 26771/2 Telegrams: Diacrome, Sheffield, 1.

FOR ALL—

The HARRIS PLATING WORKS Ltd

A.I.D. REGD. No. 153079/31.
AIR REG. BOARD AUTHY. No. A1/1268/3
D.I.ARM APPROVED No. IA/42/5/260
18 NEW WHARF ROAD, LONDON, N.1.
Telephone: TERMINUS 7263/7

HANDBOOK OF INDUSTRIAL ELECTROPLATING

E. A. Ollard, A.R.C.S., F.R.I.C., F.I.M., and E. B. Smith

Facts, figures and formulæ for all who design, erect, maintain or operate electro-deposition plant, and for laboratory workers who deal with plating solutions. Includes sections on water and drainage purifications of solutions, storage and handling of chemicals and plating-shop costing.

35s. 0d. net **by post 36s. 5d.**

from all booksellers or Iliffe Books Ltd., Dorset House, Stamford Street, S.E.1.

SERVICE
CIVILITY
SATISFACTION

We are second to none for our cash on collection buying of all

NON-FERROUS SCRAP METALS

Therefore when Selling Contact

FULL CASH SETTLEMENT ON COLLECTION

The WOLVERHAMPTON TRADING & SCRAP CO. LTD

GRAISELEY WORKS, SIDNEY STREET, WOLVERHAMPTON
PHONE: WOLVERHAMPTON 26017-8-9

Metal Finishers

ARMOURCHROME

The PROVEN Process for HARD CHROMIUM DEPOSITION

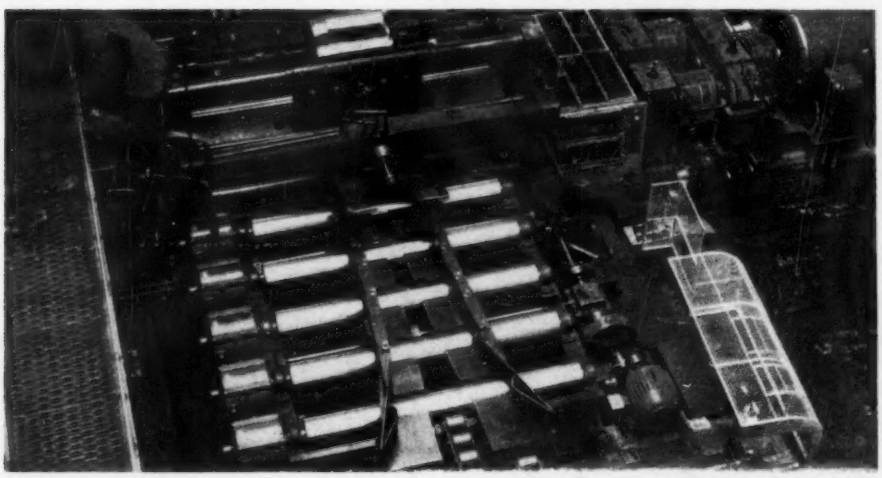
ARMOURCHROME will increase the working life of Rolls, Die-Sets and Press Tools several times. Be sure your NEW equipment is pre-treated with this cost-cutting, ultra-durable process and remember that worn, rejected components can be reclaimed by the application of ARMOURCHROME. Approved by A.I.D. Test House and the various Ministries, ARMOURCHROME provides a VDH rating of approximately 900, helps to eliminate scoring, roll mark and other blemishes from the finished job, besides giving protection from deterioration in storage. Ask our Technical Sales Department for further details NOW!

Scientific Control

Skilled Technique

The Power behind ARMOURCHROME

Precision Inspection

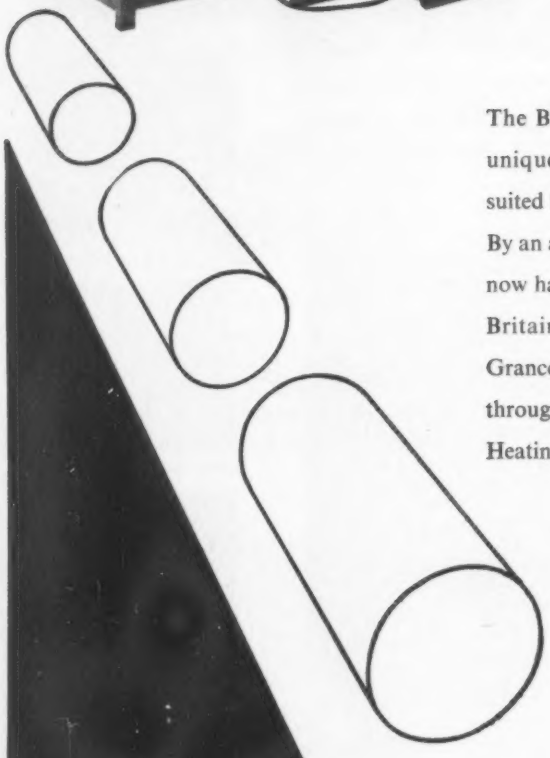


Armourchromed Rolls, over 11ft. long, in use at Banbury.
Photograph by courtesy of The Northern Aluminium Co. Ltd.

ARMOURCHROME

THE BRIGHTSIDE PLATING CO. LTD.
BREARLEY STREET · BIRMINGHAM 19 *Tel:* ASTON CROSS 2663

BIRLEC-GRANCO
RAPID BILLET FURNACE FOR LIGHT ALLOYS



The Birlec-Granco Rapid-Heating Furnace provides a unique combination of speed and economy particularly suited for heating light-alloy billets.

By an agreement with Granco Inc., U.S.A., AEI-Birlec Ltd., now have the exclusive rights to build and supply for Great Britain, Europe, and the Commonwealth Countries the Granco Rapid-Heating Furnace which is used extensively throughout America.

Heating rates of the order of 1" diameter per minute are obtained with aluminium, at economical running cost with the Birlec-Granco billet heaters which are exceedingly compact yet fully mechanised for completely automatic feed to the press.

BIRLEC

AEI-Birlec Limited

Tyburn Road, Erdington, Birmingham 24

Telephone: East 1544 *Telex No.: 33471*

LONDON · SHEFFIELD · NEWCASTLE-ON-TYNE · GLASGOW · CARDIFF

In Australasia: Birlec-Major Pty. Ltd., Moorabbin, Victoria, Australia

SM/B. 6308

METAL INDUSTRY

FOUNDED 1909

22 December Volume 99 Number 25

EDITOR
L. G. BERESFORD, B.SC., F.I.M.

MANAGING DIRECTOR
ARTHUR B. BOURNE, C.I.Mech.E.

CONTENTS

493 Editorial: Short-Term Prospects

494 Bright Anodized Aluminium

496 Publications Received

497 Correspondence

498 Research on Cobalt

499 Mechanized Heat-Treatment of Aluminium

501 Out of the Melting Pot

502 Lead and Its Alloys. *By J. F. Holmes*

503 Standard Specification

504 New Plant and Equipment

505 Men and Metals

506 Industrial News

507 Light Metal Statistics

508 Parliamentary News

509 Metal Market News:
- London
- New York
- Paris

510 Non-Ferrous Metal Prices:
- Primary Metals
- Ingot Metals
- Scrap Metals
- Semi-Fabricated Products
- Foreign Quotations

512 The Stock Exchange

©Iliffe Production Publications Ltd. 1961

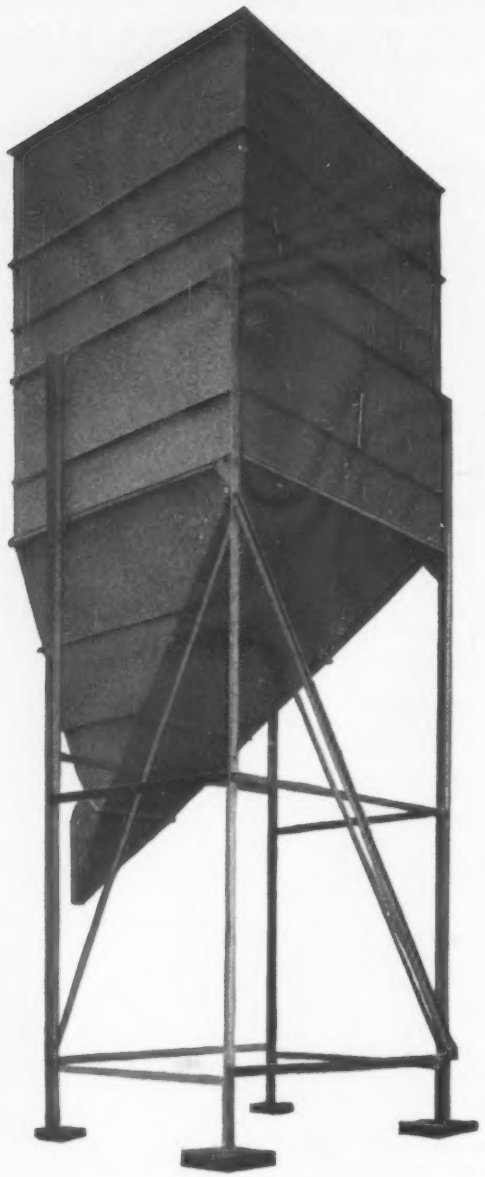
Permission in writing from the Editor must first be obtained before letterpress or illustrations are reproduced from this journal. Brief abstracts or comments are allowed provided acknowledgment to this journal is given.

PUBLISHED EVERY FRIDAY BY ILIFFE PRODUCTION PUBLICATIONS LTD.
Editorial Offices: 9 Charlotte Street, Birmingham 3. Telephone: Central 3206

Advertising and Publishing Offices Dorset House. Stamford Street, London, S.E.1.
Tel.. Waterloo 3333. Telex: 25137 'Grams: "Metustry, London-Telex"

Branch Offices: MANCHESTER: 260 DEANSGATE, 3; telephone, Blackfriars 4412 and Deansgate 3595. BIRMINGHAM: KING EDWARD HOUSE, NEW STREET, 2; telephone, Midland 7191. COVENTRY: 8-10 CORPORATION STREET; telephone, Coventry 25210. GLASGOW: 62 BUCHANAN STREET C.1 telephone, Central 1265/6

Annual Subscription
HOME £3 7s. 6d.
OVERSEAS £3 12s 0d.
CANADA AND U.S.A. $10.00
Including one copy of Metal Industry Handbook *Published Annually*



Zinc Gives High Returns

Farm equipment, exposed to the four winds and ever-wet weather, needs to be heavily galvanised to ensure its long service. The life of galvanised steel is directly related to the thickness of the zinc coating. Double the thickness means double the life—for only a fractional increase in cost.

Insist on a minimum 2 oz zinc coating

Severn Zinc

FOR GALVANISING

CONSOLIDATED ZINC CORPORATION (SALES) LIMITED, LONDON S.W.1.

METAL INDUSTRY

22 DECEMBER 1961

VOLUME 99

NUMBER 25

Short-Term Prospects

REVIEWING recent developments and short-term prospects for non-ferrous metals, the Organization for Economic Co-operation and Development states that most countries report satisfactory activity in the production of aluminium semi-products and, judging from the order book position, expect a slight rise in the next few months. In Switzerland, delivery periods have been extended from six to thirteen months. Austria, Germany and the United Kingdom, on the other hand, expect a period of stability rather than expansion.

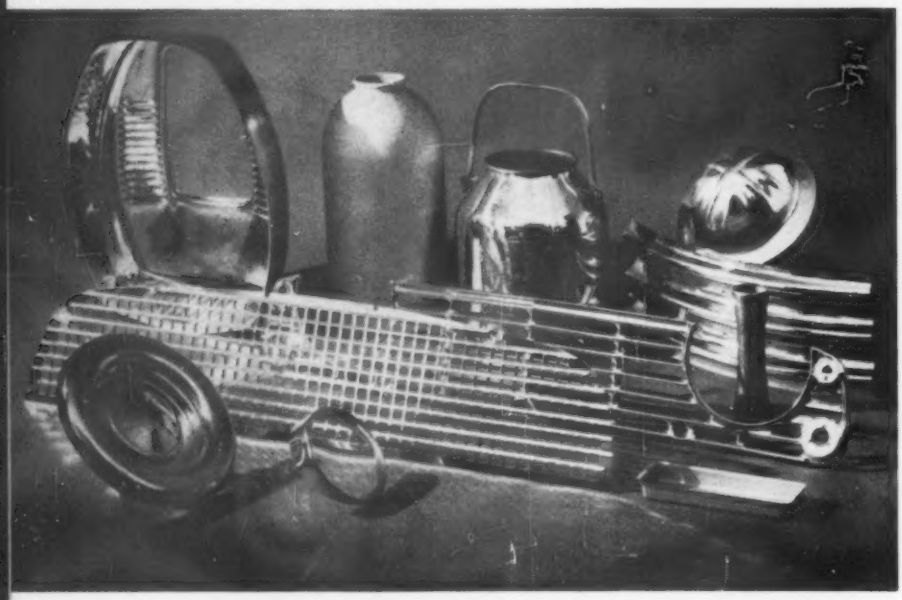
Except in the United Kingdom, where the amount of copper used in the processing industries is expected to be 5 per cent less than last year, production of copper semi-finished products has increased in most countries (Germany 16 per cent, Belgium 14 per cent above the first half of 1960). Again, a period of stability, or even a drop in business activity, may be expected. Some sectors in the United Kingdom hope to be able to continue using their production capacity to the full, but some manufacturers of copper wire, tubes and rolled products do not anticipate that their capacity will be fully employed in the early part of 1962.

Production of lead semi-products remained stable in 1961, only France and Austria recording a substantial increase in the first half of the year. In Italy, an upward trend set in during the third quarter of 1961 and is expected to be maintained. In the United Kingdom, while consumption of lead for the manufacture of sheets and pipes remained steady, the quantity used for electric cable fell in the first half. No marked change in the United Kingdom's production of semi-products is anticipated before the middle of 1962.

As in the case of lead, the zinc processing industries have raised production considerably in France, especially for rolled products. In Germany, too, production in the first nine months of 1961 was higher than in the whole of 1960. In Belgium and the Netherlands, production has remained stable. A drop of about 6 per cent compared to the record year 1960 is expected for the United Kingdom. Here, also, although activity in galvanized and rolled products remained at a high level (and should rise still further as regards galvanizing), production of die-castings will be lower.

French production of semi-finished nickel products also increased very substantially (19 per cent for pure nickel and 36 per cent for alloyed nickel), as compared to the first half of 1960. While the general trend is also favourable for nickel in the Netherlands and Italy, activity in the United Kingdom and German industries shows a downward tendency.

The Editor extends to all his readers Good Wishes for the Christmas Season



Bright Anodized

A selection from the comprehensive range of current productions from London Aluminium's new factory

AUTOMATIC chemical polishing and anodizing plant for a wide variety of aluminium products, with room for further expansion as needed, has been installed at the new Wombourn factory of London Aluminium Company Ltd. Products manufactured at the new plant include special pressings in aluminium, steel, stainless steel, etc., passenger car and commercial vehicle trim, washing machine bowls, spin dryer tubs, beer barrels, fish boxes, milk churns, trim for refrigerators and cookers, safety helmets, and bobbins for the terylene industry, etc.

The new premises include a huge 600 ft. long three-bay shop, a self-contained anodic shop and an impressive office block.

The "L"-shaped two-storey office block is equipped with air conditioning plant and large draught-free windows.

In the three-bay shop, covering 140,000 ft^2, the company have added six new presses, each with a capacity of 350 or 500 tons, to their already extensive battery of presses. The lay-out of machinery installed in the new factory has been planned in such a way that handling of materials and products is reduced to a minimum. Where equipment and products have to be moved from one section to another, mechanical means are being utilized.

Anodizing Plant

The main feature of the new works is the fully automatic chemical polishing and anodizing plant—the first to be operated in this country. It is installed in a specially built anodizing shop which has been erected at the rear of the main shop.

The plant, installed by Albright and Wilson (Mfg.) Ltd., comprises a com-

Part of the battery of heavy hydraulic and mechanical power presses in the Wombourn factory

Aluminium

plete installation providing finishing processes for automobile trim made from aluminium, the processes being Phosbrite 159 chemical polishing and sulphuric acid anodizing. These two processes are coupled together with their necessary pre- and after-treatments.

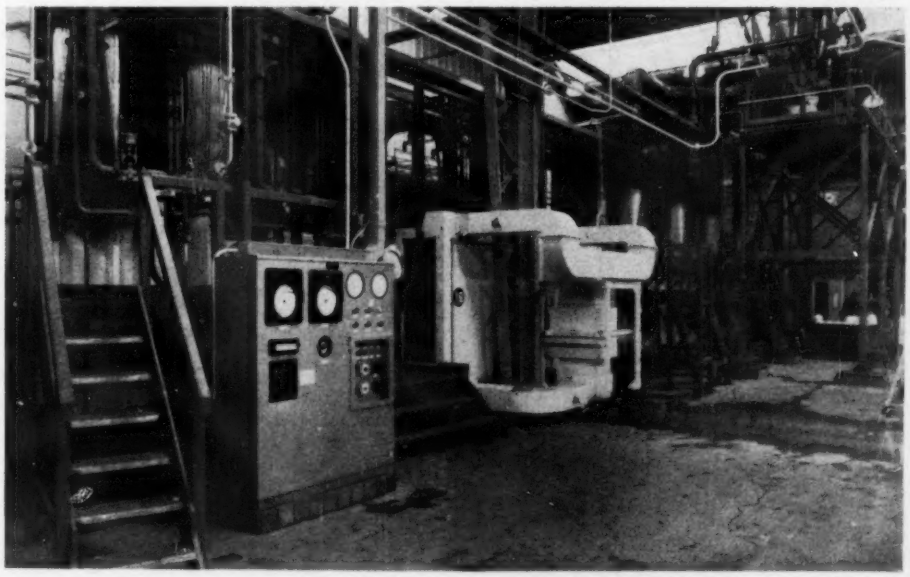
Treatment Cycle

Starting from the position where parts are loaded on to racks which carry them through the process, the treatment cycle begins with three individual stages of alkali soak, followed by a cold water rinse, nitric acid desmut and a hot water rinse. The material is then chemically polished in Phosbrite 159, fine control of this being arranged by means of a delayed set-down mechanism. A hot water rinse follows, then nitric acid desmut, and two cold water rinses before anodizing at a current density of 14 amp/ft^2. The material then passes through two cold water rinse stages and is finally hot water sealed. The racks are finally passed through a hot air dryer before unloading at the load/unload position, which occupies the space of three stations. In addition, there are two points in the line where the work can be allowed to drain before proceeding, at which inspection can take place.

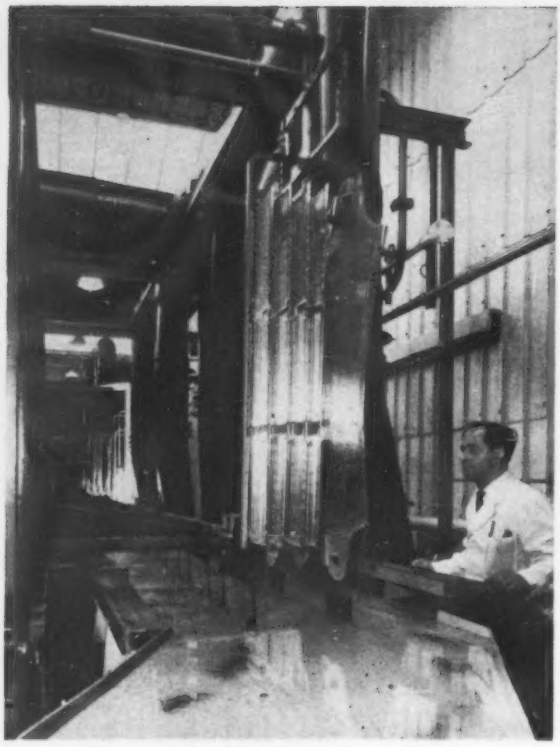
The machine is designed for very large scale production. The output may be varied by a process timer which can be set to give an immersion time in any station from zero to 5 min.

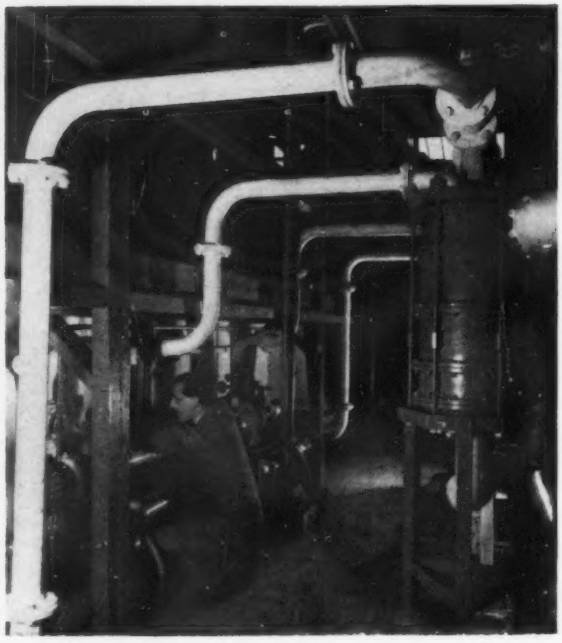
The overall dimensions of the plant are: length, 78 ft.; width, 12 ft. 6 in.; height, 16 ft. 6 in. The carrier spacing is 3 ft. and the basic tank dimensions in cross-section are 78 in. deep by 32 in. wide. The machine has a lift of 71 in., which is designed so that radiator grilles 5 ft. in length can be

Left: The contemporary two-storey office block and car park.



Right: General view of the loading side of the chemical polishing and anodizing plant, showing plant control cabinet with recording and indicating instruments, rectifier controls and conveyor controls in inset panel, air drying oven (marked 16) and stainless steel side hoods on hot water seal tank, leading via PVC ducting to extraction fans on platform





Left: Radiator grilles leaving the anodizing plant prior to rinsing and hot water sealing

Above: The heat exchange system for externally cooling the anodizing bath. Refrigeration equipment was supplied by Frigidaire

treated in the plant in the vertical position.

Construction

Considerable attention has been given to the materials of construction of the plant, so that a long life can be assured for the various components. Stainless steel (EN58J) has been used for the manufacture of the chemical polishing tank, the nitric acid desmudges and the hot water rinse tanks, while the cold water rinse tanks have been lined with white P.V.C. or lead, according to the type of treatment preceding the rinse. The anodizing tank is rubber-lined steel, the current being supplied via fitted lead cathodes. Fume removal ducting and hoods have been made from P.V.C. throughout except on the hot seal tank where stainless steel hoods are used. Similarly, the majority of the tank fittings have been manufactured from either P.V.C. or stainless steel.

Special Features

D.C. current is supplied for anodizing by aluminium busbars which are fed from a rectifier housed in a separate switch room, also containing the transformer and switch gear, remote control being provided from a panel situated in an instrumentation control cabinet near to the load/unload station. Temperature control of the anodizing bath is maintained thermostatically by regulation of the flow of chilled water through external heat exchangers, which are of the high efficiency carbon block type. Particular care has been taken to ensure that the returning flow of acid is distributed evenly throughout the tank by splitting the flow into multiple inlet points. The temperature of the chilled water supplied to the heat exchangers is controlled within a 6° F. temperature band by using multiple refrigeration condensing units, which are switched in and out according to the load required at the carbon heat exchangers.

Delayed setdown of work in the chemical polishing stage has already been mentioned. In addition to this feature there is provision for mechanically oscillating the work over a small amplitude in this stage in order to ensure uniform chemical polishing, and the uniform temperature in this tank is maintained over fine limits using an air-operated temperature controller. Temperature control is also provided on all other heated tanks and, coupled with this, use is made of a multipoint temperature indicator situated in the central control panel, so that immediate checks can be made to see that all points of the plant are operating at the correct temperature.

To avoid delays in start-up, as after a week-end shutdown, while process tanks are being heated to the correct operating temperature, a timer operated valve has been installed in a small bore steam line to preheat the steam main to a suitable temperature. A thermostat in the steam main operates the main steam valve, admitting steam to the main and, via self-actuating temperature controllers, to the process tanks. Each self-actuating controller will control the temperature of its attendant tank.

Incorporated in the effluent plant is a recirculatory system, whereby 75 per cent of the water consumed is treated and returned to the anodic shop for further use.

To deal with research and development, which is continually being carried out, a well-equipped laboratory is in operation.

Publications Received

IN THE latest issue of *G.E.C. Journal* (Vol. 28, No. 4), one of the technical articles deals with high-frequency germanium transistors. Other articles deal with mercury vapour lamps, computers for production control, microminiaturization, an oil-filled cable installation and generation and amplification in the millimetre wave field.

OUTLINING the various processes for the welding of aluminium, a booklet, *Welding Aluminium*, has been issued by Alcan Industries Ltd., Bush House, Aldwych Road, W.C.2. It describes the equipment necessary for the main processes, and the applications for which each process is best suited. Other sections deal briefly with brazing and tungsten-arc cutting. There are sections on strengths of joints, notes on welding techniques and procedures, and several tables giving optimum welding conditions for the major processes used with various thicknesses of plate.

Correspondence

Correspondence is invited on any subject considered to be of interest to the non-ferrous metal industry. The Editor accepts no responsibility either for statements made or opinions expressed by correspondents in these columns

"I'm Dreaming of a Right Rest Mass"

TO THE EDITOR OF METAL INDUSTRY

SIR,—As a change from the quizzes in the Christmas editions of the Sunday newspapers, some of your metallurgist readers may care to combat the afternoon's torpor by considering the equation

$$m_n = \Sigma_n + \frac{\Sigma_n\left(\frac{1}{\alpha} - 2n\right)\omega}{10^2} - \frac{\Sigma_n\left(\frac{1}{\alpha} - 2n\right)\omega}{10^2 n} \quad \ldots(1)$$

where $(n = 1, 2, 3, \ldots .. 68)$

and $\frac{1}{\alpha} = 137$

$$\omega = 2\pi k\alpha = 0{\cdot}0215$$

in which $k = \frac{1}{10} \cdot \frac{1}{2} = \frac{1}{12} =$ Fürth's constant

and $\alpha = \frac{1}{137}$

Equation (1) defines 68 states, each uniquely designated by a "Sigma number" Σ_n. The states defined, some of which are given in Table I, represent with considerable accuracy the mass spectrum of the charged fundamental particles, insofar as they are currently known to us, from the electron of rest mass 1 to a hyperon of mass 2346.5. Photons and heavy cascade particles lie outside the framework.

Several previous attempts to derive the mass spectrum of the particles from the fundamental constants h, c, e, α and k (but usually with m_e and m_p thrown in to prime the pump) have, of course, been made. All of them, though, are lacking in aesthetic appeal inasmuch as they entail setting up a separate equation for each particle or set of particles. None of them has accounted for all the meson masses known at the time of publication, nor displayed any great predictive value.

By contrast, equation (1), which I brought to its present form in 1956 (though I was then erroneously attempting to justify its physical interpretation in terms of wave mechanics), provides a single structure accommodating all the known meson masses. Over the last five years, there has been a gratifying tendency for new meson masses, as well as revised values for the masses of old ones, to assimilate themselves to the equation. The mass of the charged Σ-meson, for example, was thought in 1956 to be about 2,329 electron masses. The present accepted value is 2,345 electron masses, and the value from equation (1) is 2,346.5. The recently-captured Ω-meson (mass~1,540, for the neutral particle) accords well with my Σ_{55}, while Perkins' particles of mass ~1.200—which caused so much heartburning at Bagnères-de-Bigorre—can be assimilated to Σ_{48}. A comparison of the masses derived by Fürth[1], Guggenheimer[2], Horning[3] and myself, for the best-attested meson manifestations, is given in Table II.

The form of equation (1) may appear "unphysical"; it is, in fact, characteristic of the definition of a component in terms of a limited set of summations. For any number between 1 and 11, for example, the corresponding equation is

$$\left(\overset{n}{\underset{1}{\Sigma}}\right) = \frac{2\Sigma_{n-1}\left(\frac{10}{n-1}\right)}{10} \quad \ldots(2)$$

Interpretation of equation (1) in physical terms is difficult on the basis of present assumptions regarding the fundamental constants. The main difficulty arises in connection with the assumed "denseness" of time. Geometrical space has this same denseness—that is, it accords with the principle that "however thin you slice it, it's still baloney", but

TABLE I—MASS RATIOS OF THE FUNDAMENTAL PARTICLES FROM EQUATION (1)

n	$\Sigma_n = \frac{n^2+n}{2}$	$\frac{1}{\alpha} - 2n$	$\frac{\Sigma_n}{100}$	$\left(\frac{1}{\alpha} - 2n\right)\omega$	$\frac{\Sigma_n\left(\frac{1}{\alpha} - 2n\right)\omega}{10^2}$	$\frac{\Sigma_n\left(\frac{1}{\alpha} - 2n\right)\omega}{10^2 n}$	m_n
68	2346	1	23·46	0·0215	0·505	0·007	2346·48
60	1830	17	18·30	0·3655	6·689	0·11	1836·5774
55	1540	27	15·40	0·5805	8·939	0·17	1548·77
48	1176	41	11·76	0·8815	10·356	0·26	1186·10
44	990	49	9·90	1·0535	10·389	0·24	1000·15
43	946	51	9·46	1·0965	10·373	0·24	956·13
32	528	73	5·28	1·5695	8·287	0·26	536·03
23	276	91	2·76	1·9565	5·299	0·23	281·07
20	210	97	2·10	2·0855	4·378	0·22	214·16
1	1	135	0·01	2·9025	0·029	0·029	1·00

TABLE II—CALCULATED AND OBSERVED VALUES FOR PARTICLE/ELECTRON MASS RATIOS

Fürth[1]	Guggenheimer[2]	Horning[3]	Barton	Accepted[4]	Particle
—	—	2595	—	2590	Ξ (cascade particle)
—	—	2190	2346·5	2345	Σ particle
1836·4	—	—	1836·577	1836	Proton
—	1523	—	1548·77	1540	Ω-meson
—	1400	—	1378	1370	Doubtful
—	981	959	956	966	K-meson
—	—	—	536	530	ζ-meson
292	274	274	281	276	π-meson
221	216·6	202	214	210	μ-meson

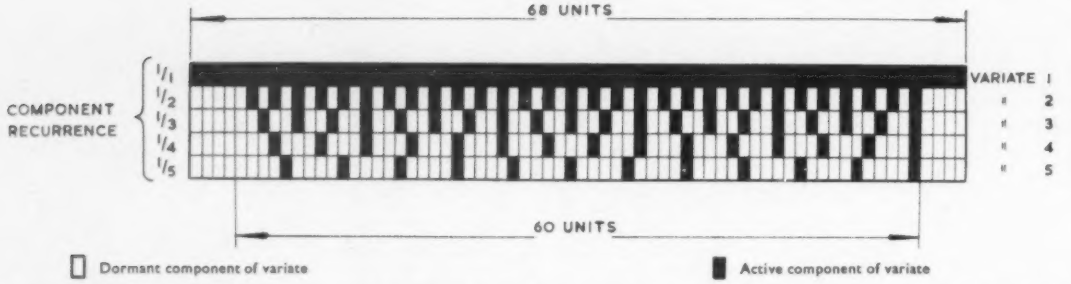


Fig. 1—Graphical representation of a matrix element (configuration) based upon the reciprocals of the first five integers, taken as probabilities of recurrence. Since the "active" components of the element can take any of the positions that, in this particular figure, are occupied by "dormant" components, the real part of the matrix consists of 120 unique elements differing in pattern from, but identical in form with, the example in the figure

physical space has not. It seems necessary, now, to drop the motion that physical time is necessarily dense. This would be in keeping with the ideas of "a smallest physical length" and "a shortest physical time interval" that have arisen from a consideration of the broader implications of the existence of Planck's constant of action[4].

I would, therefore, propose that particles do not occupy time continuously—that is, "densely"—but are manifested in successive fundamental time units ("*ftu*") that are spaced out along the time axis. It necessarily follows that a mass quantum is associated with each *ftu*, whether occupied or not. The rest mass of a particle then depends upon the number of *ftu* that it occupies, out of the number of occupiable *ftu* in a larger, recurrent time unit which would itself be "the shortest measurable time interval". This larger unit, if it is to accommodate the heaviest particles of equation (1), must consist of not less than 4,693 ($=137^2 . 2^{-2}$) *ftu*.

One then visualizes an electron at rest (to take the simplest case) as recurring regularly at a pitch of 4,693 *ftu*. Acceleration of the electron is now represented by progressive reductions in the pitch to 4,692, 4,691 . . . *ftu*, each reduction being associated with a quantum increase of energy, acquired discretely. This not only provides an exact linear analogue to the two quantum number Bohr elliptical orbit (with $k=0$), but rationalizes the speculations—lately being tossed around at Berkeley—that c may not be invariant over distances less than about 10^{-13} cm. As the pitch decreases, the energy accession at each reduction increases; in the limit the mass of the electron becomes infinite—or, better, becomes equal to half the mass of the universe. A particle of higher sigma number must be assumed to occupy a number of (non-adjacent) *ftu*, to repeat as a group at the given pitch, and to undergo acceleration in the same manner.

The possible structures of limited sets is an interesting study, and Wilbraham's too-little-regarded analysis[5] of Boole's algebra provides, perhaps, a suitable mode of treatment. Structures of considerable complexity can be derived from a very small number of probability ratios. One may take, as a not entirely random example, a set of five variates such that each has, respectively, one, two, three, four and five possible components. The probabilities of particular components occurring in a representative set are then 1/1, 1/2, 1/3, 1/4 and 1/5. Taking the reciprocals of these probabilities as pitches, and choosing one component of each variate, we obtain a configuration such as that of Fig. 1. That is, if there are four ways in which a variate can occur, the chosen way will recur every fourth time; if there are three, every third time. The configuration is the same whether one regards it as a mere logical construct, or whether one is tempted to equate the five variates with existence (which we must, in the present context, take as having a probability of 1/1), chirality (left, right), charge (+, o, −), spin ($+\frac{1}{2}$, 0, 0*, $-\frac{1}{2}$) and isotopic spin ($+1$, $+\frac{1}{2}$, 0, $-\frac{1}{2}$, -1).

The configuration of Fig. 1, as shown, represents only one choice of components from the five variates. There are altogether (including 1/1) $\Sigma_5=5+4+3+2+1=15$ components, and the number of possible configurations is $\Pi_5=5\times4\times3\times2\times1=120$. There is also a similar number of "anti-configurations" (in which the black squares of Fig. 1 are replaced by white ones, and vice versa), giving a total of 240. Configuration-space is thus eminently suitable for description by a 16×16 matrix on canonical Eddingtonian lines: the 120 "real" configurations then account for $120/256=15/32$ (whence Fürth's constant) of the matrix elements. Further, though for the choice of components shown in the figure the configuration is "end-stopped" at 60 units, the effect of fitting the configuration into a frame of 60 places would be that the same configuration would repeat indefinitely. To allow a sequence of different configurations, we must provide a frame of 68 places, the four at each end accommodating the four dormant components when the sequence of units begins, or ends, with an active component. The choice of 68 states for description by equation (1), and the position of the stable proton at Σ_{60}, are thus not arbitrary. Which is perhaps enough for one afternoon, even a Christmas afternoon.

References

1 *Nature*, 1950, **166**, 727.
2 *Nature*, 1952, **170**, 158.
3 *Nature*, 1960, **186**, 708.
4 *Nature*, 1950, **166**, 824.
5 *Phil. Mag.*, Series 4, 7 (Suppt.), June 1854.
6 *Contemporary Physics*, June, 1960, except for Ω and "Doubtful".

Yours, etc.,

Hiram Barton.
Roughfield, Etchingham, Sussex.

Research on Cobalt

MOST nickel-base alloys are essentially precipitation-hardened by means of intermetallic compounds of nickel, while cobalt-base alloys are generally strengthened by the precipitation of complex carbides of molybdenum or tungsten. It is known that a structural relationship between the precipitate and the matrix is one of the essential conditions for precipitation hardening.

An investigation along these lines is reported in "Precipitation Hardening of Cobalt-Base Alloys by Means of an Intermetallic Co-Mo Phase", appearing in *Cobalt*.

Other articles include "Cobalt-Carbon Alloys" and "Effects of Hot-Cold Working on High Speed Steels". Another recent publication of the Cobalt Information Centre is "Properties of the New Cobalt-Base Alloy UMCo 50". This contains data on the structure of the 50 per cent cobalt-30 per cent chromium-20 per cent iron alloy, as well as room and elevated temperature strengths and the effects of additions.

Data on the basic low carbon alloy show that it can be cast and forged without difficulty, has adequate room temperature strength and ductility, high-temperature tensile and stress rupture properties compare favourably with the complex "superalloys" above 900°C.; show excellent wear and abrasion resistance, particularly at high temperature; good thermal shock resistance; satisfactory machinability; good oxidation in air and air sulphur dioxide mixtures; and good corrosion resistance in sulphuric and boiling nitric acid and molten zinc.

Mechanized Heat-Treatment of Aluminium

INTEGRATED EQUIPMENT FOR HOMOGENIZING SLABS AND ANNEALING STRIP AND FOIL

INTEGRATION of the furnace equipment with adjacent processes is a feature of the new rolling mill at the Mirro Aluminum Company, of Manitowoc, Wisconsin.

Prior to rolling, ingots are homogenized in two direct-fired car bottom power convection furnaces, placed side by side (Fig. 1). The internal effective heating dimensions of each furnace are 38 ft. 6 in. long, 13 ft. wide and 6 ft. 9 in. high. Each furnace has a loading capacity of 220,000 lb.

Ingots are loaded in two rows, lengthwise to the furnace car and stacked with spacers between each ingot. A space of 1 ft. is provided between the two rows. Each of the furnaces can be charged with 36 ingots, six stacks of six high. Under these conditions, each furnace is capable of homogenizing 87,000 nett lb. of aluminium per day. This production cycle includes 8 hr. to 565°C. heating time, plus a 48-hr. soaking period.

Furnace cars are lined with insulating block, backed with an insulating blanket, and covered with aluminized steel on the top and sides. A transfer car (shuttle mechanism), travelling on rails parallel to the furnace doors, is used to transfer the furnace work cars between the loading-unloading station, the two furnaces, and a cooling chamber.

Movement of the furnace work cars, in and out of the furnace and on and off the transfer car, is handled by automatic controls mounted in a pulpit attached to the transfer car.

Each of the homogenizing furnaces has three individual heating zones. Each zone contains a power convection fan which recirculates air heated by sets of high capacity gas burners. Wind temperature in each zone is recorded and controlled by a Minneapolis - Honeywell two-position round chart controller.

Reheating for Rolling

Ingots are reheated between 480°C. and 525°C. for the subsequent rolling mill process. Two pusher type, direct-fired furnaces each have a capacity to reheat 120 ingots with a maximum load of 120,000 lb. per furnace (Fig. 2). On a batch basis, the heating is accomplished from cold to 495°C. with less than 3°C. total temperature variation in an 8 hr. cycle, or in 5 hr. with continuous operation.

The furnaces, which are identical, are divided into three separate zones. Each zone contains a power convection fan which recirculates air heated by sets of high capacity gas burners that are also installed at each zone. Fuel capacities in all three zones are equal to afford fast load heat-up on a batch type operation. Uniformity of temperature from ingot to ingot varies only slightly, within a controlled tolerance, but complete temperature uniformity is maintained within the individual ingots.

The aluminium ingots are conveyed through the furnaces on roller shoes, travelling on steel rails. The loaded shoes are pushed through the furnace by means of a hydraulic, gravity dog pusher mechanism. The ingots are placed on the shoes in an inclined vertical position, and are advanced through the furnace, shoe against shoe. Work is automatically removed from the furnace at the discharge end of the furnace by hydraulically operated pull-out bars with gravity dogs. The pull-out bar engages the loaded shoe, moving it from within the furnace chamber, and positioning it outside the discharge door. The empty shoes are returned to the charge end in an inverted position on rails which are continued under the furnace. As the shoes are discharged, they are automatically locked into a platform which rotates 180° to a position that lines up with the bottom set of rails. An endless chain conveyor pushes the shoes to the charge end where a similar platform rotates 180° and raises the shoes to a greasing and inspection station, which is a part of the rail structure at the charge end of the furnace. All operations are automatic and synchronized by a time cycle.

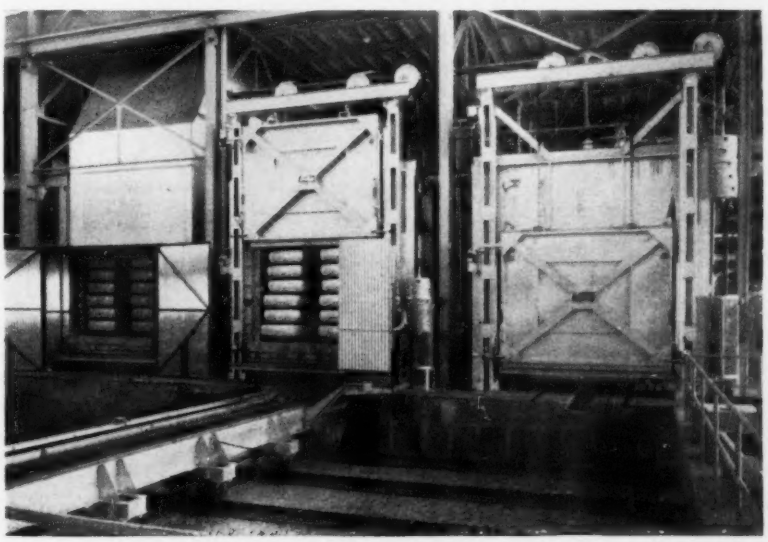
The furnace casing plates are constructed of steel, and the bottom plates are reinforced by structural steel members. The floor of the furnace is of cast insulating refractory, covered with aluminized steel sheets. The walls, roof and doors of the furnace have a metal inner-lining of modular construction, designed to prevent wind channelling into and through the insulation.

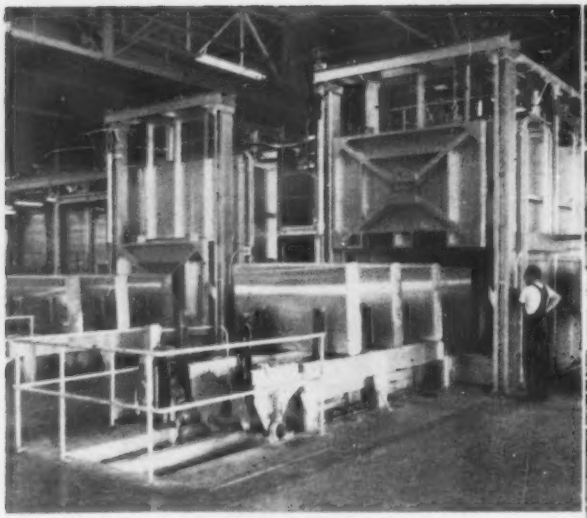
The hot mill operator, using automatic controls, causes ingots to be discharged from one of the two reheat furnaces and delivered to the hot mill table.

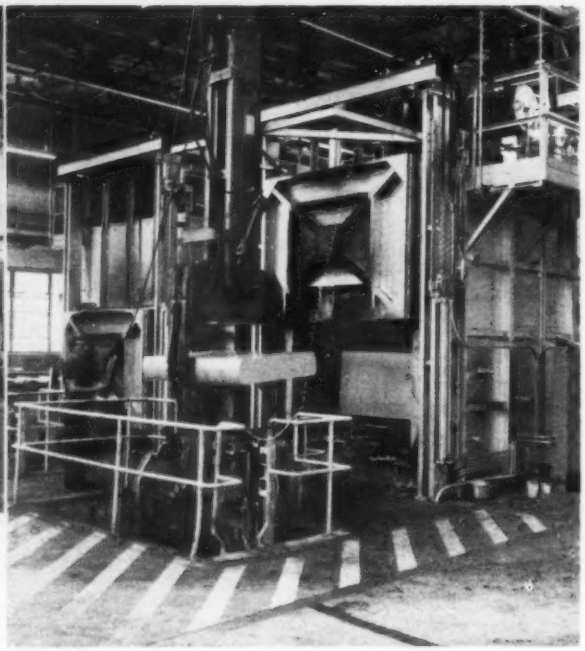
Hot Rolling

The hot mill is a 2-high reversing mill breaking down the original 10 in. thickness to the final thickness of $\frac{3}{16}$ in. The table drives are synchronized to reverse when the hot mill rolls reverse.

Fig. 1—Two homogenizing furnaces at the right each having an ingot loading capacity of 220,000 lb. The unit at the left is a cooling chamber







Above: Fig. 2—Charging ends of the two reheating furnaces. Each of these continuous furnaces has a capacity of 120 ingots with a maximum load of 120,000 lb. each

Right: Fig. 3—Discharge ends of reheating furnaces. A billet is shown being extracted from the furnace to be delivered to the hot mill

The table on one side of the mill is 250 ft. long and is extended 320 ft. on the other side of the mill. At the end of this longer run-out table is the shearing, trimming and coiling equipment. Rolling time on the hot mill is approximately 4 min/ingot.

Cold Rolling

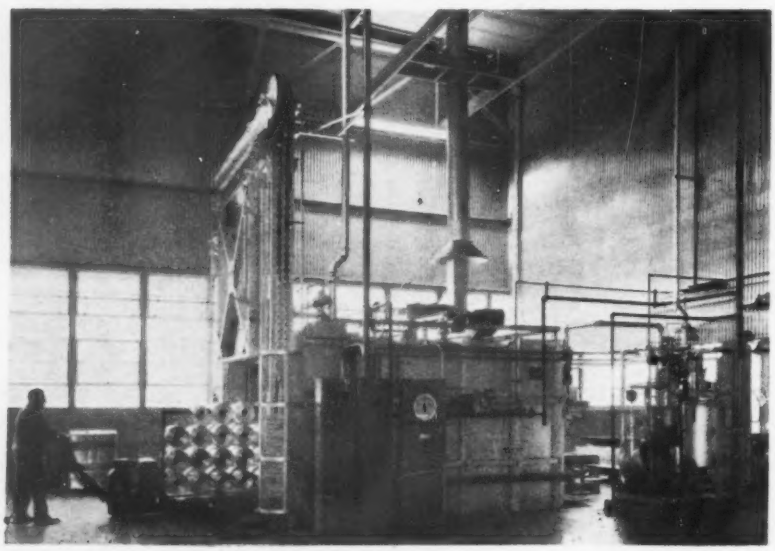
After the hot rolling reduction, the aluminium sheet is taken to a 4-high 60 in. cold rolling mill for further reduction at some 50 per cent/pass.

On completion of the rolling operations, the coiled aluminium goes to the slitting operation. Slitting takes place at a speed of 500 ft/min. Coils which will be used for forming into products requiring deep drawing are taken to one of two coil annealing furnaces for a softening process. The coils are heated between 230°C. and 480°C., depending upon the alloy and the temper required.

Foil Mill

The coils of aluminium to be used for foil production are sent to a 4-high foil mill for further reduction down to a foil thickness of 0·0007 in. The foil mill is enclosed in a special room pressurized by a blower system, admitting only filtered air. This enclosed area keeps the foil mill free from dust, which might contaminate the metal and cause pin holes in the finished foil. The foil mill is similar to the cold rolling mill, and operates at an average speed of 800 ft/min. on early passes. On thin metal passes, the mill speed may be increased to 2,200 ft/min. During the foil rolling operation, coolant oil is continually flooded over the rolls to remove the heat as it is generated.

Fig. 4—Foil annealing furnace with a gross load capacity of 15,000 lb. Gas generator at the right provides atmosphere which blankets the foil in the furnace and protects it from oxidation



Foil Annealing

Coiled aluminium foil is annealed in a furnace with inside effective heating dimensions of 7 ft. wide, 7 ft. high and 11 ft. long. The furnace has one door with an opening clearance of 7 ft. through which work cars, loaded horizontally with foil coils, are charged and also discharged. The work cars are specially equipped with arbor fixtures so the coils can be inserted on them horizontally without touching coil against coil. The loading pattern permits a gross load capacity of 15,000 lb. The furnace heats the load to 340°C. in 7½ hr., including a 2½ hr purge at 193°C. using an exothermic gas generated by a Surface Combustion gas generator. The work is cooled from 340°C. to 193°C. in approximately the same period of time required for heating. Coils are then discharged and allowed to cool to room temperature.

The two homogenizing furnaces, the two reheat for rolling furnaces, the foil annealing furnace and the gas generator were all built and designed by Surface Combustion Division, Midland-Ross Corporation, Toledo, Ohio. British associates of the company are British Furnaces Ltd. and Stein & Atkinson Ltd.

OUT OF THE MELTING POT

Once More IT has been necessary on several occasions to comment on the reluctance of investigators concerned with the effect of environment on the mechanical properties, both static and dynamic, of metals, to speculate regarding the mechanism of such effects, or to generalize, in view of the fact that, with the exception of the few tests carried out in a vacuum, all determinations of mechanical properties must to a greater or lesser extent be affected by the surrounding medium, be it air, a corrosive solution, a surface oxide film or an electrodeposit. Even this cautious attitude, however, is preferable to that of investigators who, not directly concerned with the effect of the surrounding medium, cheerfully disregard it altogether. They go on to discuss, for example, the formation and behaviour of slip lines and slip bands formed on the surface of fatigue test-pieces and the possible mechanism of fatigue crack nucleation as if the surrounding atmosphere—and usually a laboratory or industrial atmosphere at that—simply did not exist, and as if any metal surfaces that become exposed in the course of the formation of slip lines and bands just remain in their as-formed state of pristine purity. In this connection all the information that has been gathered on the reactivity of freshly formed surfaces, on adsorption, chemisorption, active centres, the surface migration of adsorbed materials, etc., would appear to be as if it had never been painstakingly collected. As yet another corrective for this mechanistic attitude, there is the welcome opportunity to mention the findings of recent tests in which single crystals of aluminium were pulled in tension in a solution of stearic acid in paraffin oil, and it was found that while the concentration of the stearic acid did not affect the critical resolved shear stress, the extents and slopes of Stages I and II were affected greatly, the weakening effect appearing to be controlled by the rate of desorption of the metal soap formed by the reaction of the surface active agent and the metal surface.

Mutual Instruction WHETHER or not the attempts to manufacture by hot pressing such materials as aluminium nitride, silicon nitride, silicon carbide, uranium dioxide, boron carbide, molybdenum disilicide-alumina mixtures, and the like fall within the scope of powder metallurgy, mutual interest exists between this work and what is perhaps more usually considered to be powder metallurgy. In powder metallurgy, whatever the difficulties attending the theoretical understanding of sintering, sintering in practice is a relatively simple matter, with the ease of sintering loose powders being available in some instances, and such devices as activated sintering and hot pressing being adopted more often for reasons of "elegance" or convenience than by reason of dire necessity. This simplicity has tended to produce a somewhat casual approach. It is perhaps by contrast with this firmly established casual attitude of powder metallurgy towards the facile sintering operation that the difficulties of work with those other refractory unsintering, though not necessarily unsinterable, materials tend to loom so large. Nevertheless, work with those less amenable materials still tends to pursue its objectives by way of high temperatures and pressure and to neglect consideration of various fundamental aspects. These aspects include, for example, the effects of interatomic bonds (metallic, covalent, ionic) on sintering, the effect of impurities, and more especially of surface contamination, and the effects of particle size in its inverse relation to surface activity. Practical issues arising in connection with these fundamental aspects include the production of materials of controlled purity and extremely fine states of subdivision, the resort to surface decontaminating treatments prior to pressing and sintering, without intermediate exposure to risk of renewed contamination, and the examination of the possibilities of using surface-activating additives or sintering-catalyzing materials, and ways of introducing them.

More Disperse IN the manufacture of dispersion-hardened compositions, i.e. metallic bodies consisting of a metal or alloy with a refractory compound dispersed in finely divided form throughout the metallic mass, the emphasis must very definitely be placed on dispersion in a fine state of subdivision. The method used must also allow the preparation of compositions containing the optimum proportion, which may be large, of the hardening phase by volume. While the latter requirement can be satisfied, especially when using powder metallurgical techniques, existing methods which depend on simple mixing in of the hard constituent, or on its formation *in situ*, e.g. by partial oxidation of the metallic constituent or the thermal decomposition of a specially added compound, are still quite far from meeting the other requirement, namely adequate fineness of the dispersed phase. A considerable improvement in this respect is claimed for a method in which a compound, from which the hardening constituent is formed during sintering, is precipitated from solution in the presence of the metallic constituent. For example, aluminium hydroxide can be precipitated by treating a slurry of nickel powder in aluminium chloride solution with ammonia. As an aside, it may be mentioned that this might perhaps be followed by slip casting and sintering. The procedure claimed, however, is to dry the resulting nickel powder-aluminium hydroxide sludge at 50-60°C., press it into compacts and sinter these at 1,400°C., with gradual heating in a vacuum to allow for the removal of water and the decomposition of the aluminium hydroxide to form alumina. The nickel-alumina composition produced by the above method contains alumina in the form of a uniformly dispersed phase consisting of particles less than one micron in size. Any advance on one micron?

Skimmer

Lead and its Alloys

By J. F. Holmes, A.I.M.

REVIEW OF MECHANICAL AND PHYSICAL PROPERTIES AND USES

(*Concluded from* METAL INDUSTRY, 15 *December* 1961)

STUDY of the equilibrium diagram and constitution of the copper-lead system by Pelzell[41] showed that the copper-lead eutectic contains 0·06 per cent copper at 326°C.

The addition of small amounts of copper to lead improves the resistance to recrystallization, creep resistance and the endurance limit. The fatigue strength at 20×10^6 cycles for a 0·06 per cent copper-lead alloy has been given by Laidler[27] as 610 lb/in², as compared to 460 lb/in² for pure lead.

The mechanical properties of a 0·058 per cent copper-lead alloy were investigated by Tietz.[42] Tensile, compression and creep properties were covered at 100°F., 175°F., 250°F. and 325°F. It was found by Glander[43] that 0·06 per cent copper reduced the extrusion pressure of lead-antimony alloys by 7 per cent.

Lead - silver - copper alloys give improved grain - size and improved creep rates, additions of 0·003-0·005 per cent each of silver and copper increasing the tensile strength by 15 per cent as well as improving the fatigue- and creep-resistance. Laidler (*loc. cit.*) gives examples of improved creep rates over a period of 200 days, where an elongation of 3·0 per cent was obtained compared with 10·8 per cent for pure lead. Fatigue strengths at 20×10^6 cycles were 605 and 460 lb/in² respectively. The relevant B.S. specification is B.S.1085 : 1956.

Lead-Silver Alloys

Silver is added to lead to refine the grain structure and to improve the resistance to vibration; it also increases the hardness. The silver-lead eutectic contains 2·25 per cent silver and 97·75 per cent lead, and freezes at 303°C.

Gohn and Ellis[44] found that up to 0·015 per cent silver improved the creep-resistance of lead at 400 lb/in² and above. The improvement at 400 lb/in² was found to be only one-quarter of that at higher stresses, and there was no appreciable improvement at 250 lb/in². Additions of more than 0·010 per cent silver did not improve the creep rate, nor was any improvement found on the addition of 0·061 per cent of copper to the higher silver alloy.

It was found by Butler[45] that the resistance of lead to recrystallization was improved only slightly by additions of copper, antimony or nickel in amounts not exceeding 0·03 per cent. The high resistance of lead with 0·005 per cent each of silver and copper to recrystallization was thought to be due to the silver.

Lead-Cadmium Alloys

Lead alloys containing cadmium were developed to give improved creep and fatigue resistance and increased tensile strengths. These alloys are capable of precipitation hardening.

Alloys of lead with tin and cadmium and with antimony and cadmium are also used for improved mechanical properties. An alloy of lead with 0·15 per cent cadmium and 0·40 per cent tin has practically double the fatigue strength of commercially pure lead, and an alloy with 0·25 per cent cadmium and 0·50 per cent antimony has a fatigue strength over four times greater than pure lead together with greatly improved creep strength.

Lead-Calcium Alloys

A 0·02-0·028 per cent calcium-lead alloy used as a creep-resistant sheathing for some telephone cables has marked age-hardening properties. Rapid cooling from near the melting point gives an alloy which, in a few weeks, increases in strength to a marked degree.

Calcium-lead of 0·028 per cent aged one year at room temperature shows an endurance limit of 1,700 lb/in² at 700 cycles/min., an increase in tensile strength from 3,000 lb/in² to 4,500 lb/in², and a reduction from 40 to 25 per cent in elongation.[46]

Calcium also figures in the German railway bearing metal, "Bahnmetal", which has the composition calcium 0·7 per cent, sodium 0·6 per cent, potassium 0·3 per cent, lithium 0·04 per cent, aluminium 0·2 per cent and lead 98·6 per cent; and "Satco", with 0·50-0·75 per cent calcium and 1·5-2·0 per cent tin. These bearing metals have similar properties to the Babbitt alloys but retain their properties better at elevated temperatures. Corrosion is liable to be a problem with alkali-hardened leads.[47]

Fusible Alloys

Lead is a constituent of most of the low-melting or fusible alloys. These alloys, with bismuth as the principal metal, are used for tube-bending alloys, fusible plugs for boilers and in the sprinkler-heads of fire-fighting devices, for anchoring punches and dies and for easily-torn solder joints.

Examples of fusible alloys are given in Table IX.

The proprietary alloys, Cerrobend, Cerrobase, Cerromatrix and Cerrotru are other examples.[48] Tensile strengths vary from 3,584 lb/in² in the case of Wood's metal to 7,616 lb/in², and elongations from 200 per cent to 78 per cent.

Cerromatrix, an alloy of 48 per cent bismuth, 28·5 per cent lead, 14·5 per cent tin and 9 per cent antimony, has a tensile strength of 13,000 lb/in² and an elongation of less than 1 per cent on 2 in. It is stated to resist deformation of up to 8 tons/in² for short periods (30 sec.), 5 tons/in² for 5 min. and continuous loads of 250-300 lb/in² for long periods.[49]

Other Alloys

Thallium increases the resistance to deformation of lead-base bearing alloys. An alloy of 72 per cent lead, 15 per cent antimony, 5 per cent tin and 8 per cent thallium has been reported as having

TABLE IX—FUSIBLE ALLOYS

Alloy	Composition (per cent)					M.P. °C.
	Bismuth	Lead	Tin	Cadmium	Silver	
Newton's Alloy	50	31·25	18·75	—	—	95
Rose's Alloy	50	28·0	22	—	—	100
D'Arcet's Alloy	50	25	25	—	—	93
Wood's Alloy	50	24	14	12	—	71
Lipowitz's Alloy	50	27	13	10	—	60
Guthrie's Metal	47·38	19·36	—	13·29	19·97	71·1
Lictenberg's Alloy	50	30·0	20	—	—	94·5

TABLE X—LITHIUM-LEAD ALLOYS

Lithium (per cent)	Stress lb/in²	Elongation (per cent on 7·5 cm.)	Stress Rupture Life (hr.)	
0·68	2,000	10·0	297	At room temp.
0·69	500	19·3	598	At 110°C.

superior yield-point and ultimate stress properties to the best tin-base bearing metals.[50]

Lithium is another element which is receiving attention as an alloying agent for pure lead, particularly for use in nuclear-shielding applications.

A lead-lithium alloy containing 0·69 per cent lithium has an appreciably higher tensile strength than pure lead and the lithium provides neutron absorption properties.[1] Jansen *et al*[51] carried out investigations on the 0·69 per cent lithium-lead alloy's alloying and mechanical properties and reported a superior strength at room-temperature to pure lead, but found that a 0·058 per cent copper-lead had superior creep-strength at 110°C.; the corrosion resistant properties of the lithium-lead alloy were also found to be inferior to those of the copper alloy. Detailed tables of the results of tensile and corrosion tests were given by the same authors.[52] The properties in Table X were reported at room temperature and 110°C.

Kubaschewski and Schneider[53] reported that an alloy of 70 per cent tungsten and 30 per cent lead, having a density of 15·4 gm/c.c. and a Brinell hardness of 108 at room temperature, was superior to most heavy bearing metal alloys.

Improved tensile and other properties were found with silicon contents of up to 0·035 per cent by Teresarva,[54] and the effect of thallium additions on creep-resistance were reported by Gifkins,[55] who plotted the effects of additions of 0·5 per cent, 0·5-8·0 per cent, over 8 per cent and 40 per cent.

Magnesium has the property of hardening lead, but the alloys break down in the presence of moisture; 0·25 per cent magnesium is stated to increase the tensile strength of cast lead from 1,970 lb/in² to 4,950 lb/in².

Arsenic renders lead harder and refines the grain structure. Small additions to lead and lead containing such metals as antimony and silver have been investigated to determine the improvement in fatigue strength and creep-resistance. Additions of 0·3-0·8 per cent of arsenic to lead shot, made by the old shot tower process, produced spherical shot by alteration of the surface tension of the lead or, as stated by Williamson,[56] by forming lead arsenite with the layer of oxide which would otherwise prevent the shot becoming round.

Emicke[57] examined the lead-arsenic alloys as substitutes for lead-antimony alloys with up to 3 per cent antimony and examined particularly the 0·05-0·20 per cent arsenic alloys. He concluded that the lead alloys containing up to 0·1 per cent arsenic were superior to antimonial leads.

Teresarva[54] found that in the lead-silicon system, tensile and other properties at room temperature improved with silicon content up to 0·035 per cent.

The solubility of nickel in molten lead was determined by Alden *et al*[58] as 0·53 per cent at 372°C., and additions of nickel have been found to improve greatly the tensile strength of lead.

Less conventional forms of lead, which may have increasing use, are the sintered and compressed powdered leads with applications as bearing metals and in X-ray and atomic energy radiation shields.

Experimental work in dispersing metal powders of low solubility, such as copper, nickel or cobalt, in molten lead to improve tensile properties has been described by Williams *et al*.[59] The incorporation of fibres, e.g. of steel, has also been explored[60].

Lead has lately been challenged in some of the fields in which it has, hitherto, been supreme, as, for example, by the use of plastics and copper water pipes, plastics materials for corrosion-resistant linings and for cable coverings. With expanding demand for lead in nuclear shielding applications and with intelligent use of its unique properties and proper consideration of design and of the improved alloys available, there is no doubt that lead is still as valuable to man as ever in its long history.

References

41 E. Pelzell, *Metall.*, 1956, Nov., **10**, 21/22, 1023.
42 T. E. Tietz; WADC Tech. Report 56-695, Austric. Doc. 1511655, Wright Air Dev. Corpn., Ohio Office of Tech. Services Publn., 131818.
43 F. Glander and W. Glander; *Z.Metallkunde*, 1955, **46**, 552.
44 G. R. Gohn and W. C. Ellis; *Met. Ind.*, 1948, **73**, 333.
45 J. M. Butler; Report A1140, B.N.F.M.R.A.
46 A.S.M.E. Handbook, "Metal Properties", 1st Edn., 1954, McGraw-Hill Co., New York.
47 C. H. Hack; *Product Engineering*, 1935, **6**, 456.
48 Registered trade names of Cerro de Pasco Co.
49 W. C. Smith and O. J. Seeds; "Modern Uses of Non-Ferrous Metals", Ed. C. H. Mathewson, 2nd Edn., A.I.M.E., New York, 1953.
50 Metal Industry Handbook and Directory, 1938, 34.
51 D. H. Jansen, E. E. Hoffman and D. W. Shepherd; ORNL-2404, TID-4500.
52 D. H. Jansen, *et al*; *J. Nuclear Metals*, **1**, (3), 249.
53 Kubaschewski and Schneider; *Z.Elektrochem.*, 1942, **48**, 671.
54 M. Teresarva; *Nippon Kinzoku Gakkaishi*, 1958, **22**, 1. (Reported in *Ind. Eng. Chem. Review*, 1959, **51**, 1185.)
55 R. C. Gifkins; *J. Inst. Met.*, 1953, **81**, 417.
56 M. W. Williamson; *Metal Progress*, 1947, **52**, (3), 393.
57 O. Emicke; *Metall.*, 1950, **4**, (1/2), 1, (3/4), 48.
58 T. Alden, D. A. Stevenson and J. Wulff; *Trans.A.I.M.E.*, 1958, **212**, (1), 15.
59 D. N. Williams, J. A. Houck and R. I. Jaffee; *Metal Progress*, 1960, Feb., **77**, (2), 79.
60 T. Kimura; *Pulvermet.*, 1959, Aug., **7**, 50.

Standard Specification

Ingot Zinc (*B.S.*3436:1961). *Price* 4*s*.

IN this standard, four earlier standards have been collected into one publication, B.S.3436, which covers the chemical composition of four grades of ingot zinc. The standards replaced are: B.S.220, Fine Zinc; B.S.221, Special Zinc; B.S.222, Foundry Zinc; and B.S.1003 High Purity Zinc.

The requirements covered by these earlier standards have been reviewed in the light of Services' requirements, and the four new grades correspond as closely as possible to those which are being considered for international standardization, and relate only to primary or virgin zinc.

General requirements for the four grades have been grouped together in the standard. Alloy numbers, prefixed by the letters Zn, have been allocated to each material.

What are considered to be realistic limits are now included for certain minor impurities in the grades of zinc corresponding to those previously covered in B.S.220-2, but it is not usually necessary for these elements to be determined by chemical analysis.

No change has been made to the high purity grade Zn 1 — previously specified in B.S.1003—used principally for the manufacture of die-casting alloys which are liable to intercrystalline corrosion unless their contents of lead, cadmium, tin, indium and thallium are held within very low limits.

Copies of the above-mentioned standard may be obtained from the British Standards Institution, 2 Park Street, London, W.1.

New Plant and Equipment

Vacuum Brazing

AN electrically heated, cold retort furnace, specially designed for brazing components in vacuum, has been introduced by Royce Electric Furnaces Ltd., Albert Drive, Sheerwater, Woking, Surrey. The furnace is fitted with a molybdenum wire element providing temperatures up to 1,200°C., and operating vacua down to 10^{-5} mm. mercury can be obtained.

The furnace chamber is water-cooled, domed at the bottom and having a removable domed cover to give access to the interior. It provides a work space 8 in. in diameter and 8 in. high, the charge being placed within the cylindrical element on a support made up of molybdenum rods with alumina top covers. The element is surrounded by radiation screens of Nilo K with an inner screen of molybdenum. Screens are assembled with molybdenum tubes and spacers and are housed in a steel canister supported within the chamber. Another assembly of radiation screens of the same materials provides a removable top cover. The element operates at a low voltage supplied by an infinitely variable voltage regulator transformer.

Temperatures are controlled automatically with a two point recorder housed in a wall mounting panel. Leads to the thermocouples can be taken through the molybdenum tubes in the radiation screen assembly without disturbing the whole assembly.

The furnace is supplied as a packaged unit complete with control gear and Edwards Speedivac pumping equipment, which is mounted beneath the operators' platform.

Magnetic Separation

FOR extracting fine iron present in free-flowing processed material, Rapid Magnetic Limited, Lombard Street, Birmingham, 12, have introduced their WY/WZ range of electro magnetic chute separators.

Magnetically held bridges incorporated in this range of chute separators for free flowing materials ensure that during a power failure the material is directed from the main flow. A WY unit is 18 in. wide with two poles, and is capable of treating approximately 20 tons/hr.; the WZ unit will handle double this throughput.

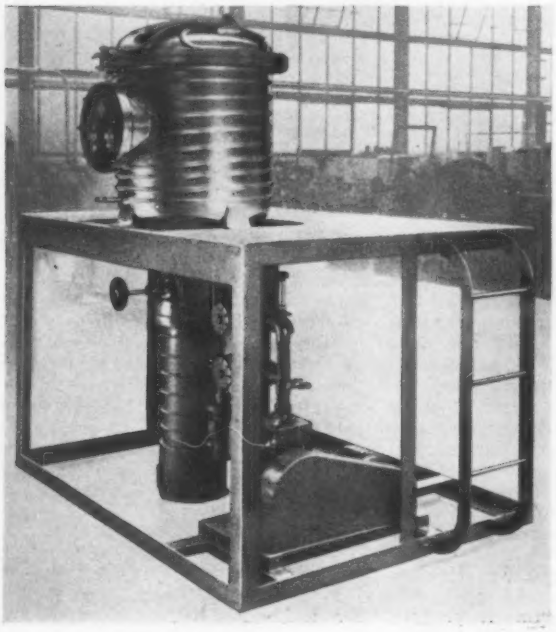
Totally enclosed types with the associated trunking can be supplied to customers' specifications.

The Rapid Magnetic WY/WZ electro-magnetic chute separator for free-flowing materials

Liquid Chilling

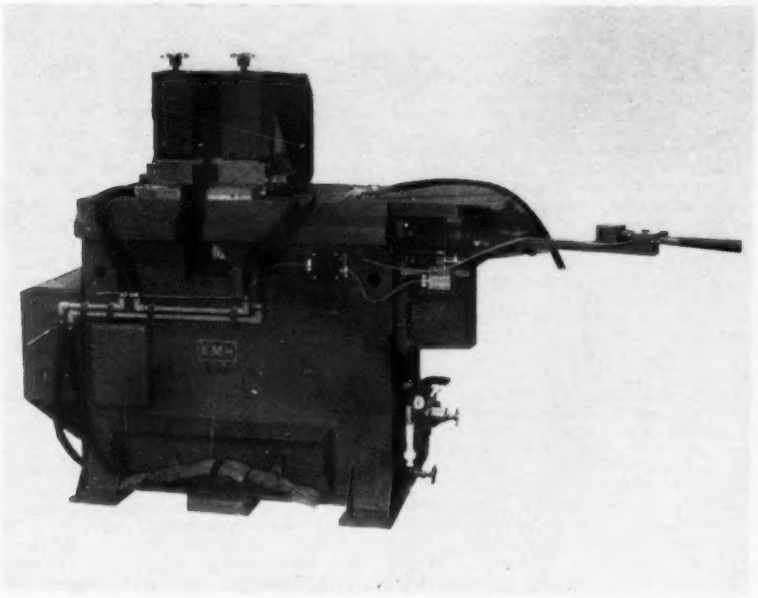
RECENTLY introduced by Carter Thermal Engineering Ltd., Redhill Road, Birmingham, 25, a new design of liquid chilling unit has a wide range of applications, including chilling water for air conditioning systems and other industrial processes. It also has numerous applications for cooling other liquids and gases, sometimes to zero temperatures.

It is available from 1½ to 22½ h.p. and is delivered completely wired ready to install, only power and liquid connections being required. Non-ferrous water passages minimize corrosion problems and the simple "uncluttered" design makes the unit compact yet accessible for cleaning and servicing. High efficiency heat exchangers give the smallest possible floor space and



Left—Electrically heated cold retort furnace designed for vacuum brazing by Royce Electric Furnaces Ltd.

Below—Liquid chilling unit produced by Carter Thermal Engineering Ltd.



Semi-automatic welding machine—the SBA51—manufactured by Electro Mechan-Heat Ltd.

the semi-hermetic system ensures greater reliability.

Larger size packaged units are available with different layout.

Hand Welding

A SEMI-AUTOMATIC hand-operated flash or butt welding machine with pneumatic clamping, which greatly reduces operator fatigue on long production runs, has been introduced by Electro Mechan-Heat Ltd., of Manor Works, Ettingshall, Wolverhampton.

Overall dimensions of this equipment —the SBA51—which weighs 1,960 lb., are 67 in. wide by 39 in. deep by 55 in. high. Its nominal rating is 50 kVA, with a peak upsetting power of 90 kVA.

Tubes up to 1·55 in^2, flats up to 1·86 in^2, and bars up to 2·48 in^2 in cross-sectional area can be welded. For the welding of rings and frames, these areas must be reduced by 30 per cent.

The clamps operate vertically, exerting a pressure of approximately 3 tons on a cylinder pressure of 5 kg/cm^2 (71 lb/in^2). The piston movements from two 4-in. bore pedal-activated cylinders at the back of the machine are transmitted by levers to the clamping mechanisms. Clearance between the water-cooled copper jaws of the clamps can be adjusted by hand screws over a distance of 2·36 in.

The moving table is controlled by a hand lever and quadrant assembly. Various rates of burn-off can be set on the quadrant, which is graduated in millimetres. Adjustments to a connecting arm at the base of the hand lever alter the upsetting pressure, which can be varied between 2 and 3 tons for a force of 88 lb. applied to the lever. Initial clearance between the two tables is adjustable between 0·57 in. and 4·7 in.

Welding current is controlled through a heavy duty 2-pole magnetic contactor, the current being initiated by means of a trigger on the traversing hand lever. Any number of pre-heating strokes can be made to bring the workpieces up to welding temperature. When the arm of the hand lever reaches the pre-setting pointer on the burn-off quadrant, the welding current is automatically cut off.

There is a blow gun for the removal of flash between welds. The transformer is completely protected by copper and phosphor-bronze screens.

MEN and Metals

Officers of the newly-formed Stoke-on-Trent Metallurgical Society have been elected as follows:—chairman, **Mr. N. B. Rutherford,** B.Sc., A.I.M. (Thomas Bolton and Sons Ltd.); vice-chairman, **Mr. E. S. White** (Birkett, Billington and Newton Ltd.); treasurer, **Mr. D. Clarke,** A.I.M. (Royal Ordnance Factory, Crewe); secretary, **Mr. B. M. Hardman,** F.I.M. (North Staffordshire College of Technology); committee—**Mr. C. H. Charsley, Mr. J. Dowell, Mr. D. Heath, Mr. D. Lowe,** B.Sc.; **Mr. W. J. Williams,** M.Sc.; **Mr. T. J. Stanistreet, Mr. J. L. Wolfenden,** B.Sc., A.I.M.; and **Mr. C. S. Dobson,** B.Sc., F.R.I.C., F.I.M.

It has been announced by Crompton Parkinson (Stud Welding) Limited that **Mr. Brian D. Hughes** has recently joined the company as special projects engineer. Previously, Mr. Hughes was with W. S. Atkins and Partners, the civil engineering consultants, as a design engineer.

Executive director and secretary of Griffin and George Limited, and its subsidiaries, **Mr. H. C. Mayer,** F.A.C.C.A., has been appointed deputy managing director of the group.

Joining Pinchin Johnson and Associates Limited as a research chemist in 1950, **Mr. P. G. Houchell,** B.Sc., A.R.I.C., has been appointed chief chemist of the group research division.

News from C. C. Ward and Sons Limited, metal merchants, of Birmingham, is to the effect that **Mr. Maurice Harraway** has been appointed a director of the company. For some time Mr. Harraway has occupied the position of general manager.

Ferodo research scientists have been awarded high honours by the Institution of Mechanical Engineers and recently, at the headquarters of the Institution, **Mr. T. P. Newcomb,** who has been with Ferodo Limited for some years, was presented with the Starley Premium award for a series of Papers presented to the Institution over the past three years. During the 1960 session of the Institution, another Ferodo member—**Mr. G. A. Harper**—was awarded the Viscount Weir Prize for the best graduate's Paper.

It has been announced by Electro Mechanisms Limited that **Mr. F. A. Ramage,** A.M.Brit.R.E., has been appointed as their technical sales manager. Mr. Ramage was formerly sales manager of Technical Ceramics Limited.

Appointed to the Mining Department of G.E.C. (Engineering) Limited, at Erith, **Mr. A. Cole,** A.R.S.M., A.M.I.M.M., will maintain contact with mining companies and, among his other duties will supervise, if necessary, the commissioning of G.E.C. mining plants in this country and overseas.

News from British Insulated Callender's Cables Limited is that **Mr. F. C. Walmsley,** M.I.E.E., Mem.A.I.E.E., is joining the company on January 1 next as assistant divisional manager, capacitor division.

Industrial News *Home and Overseas*

A Birmingham Event

Early notice is given of the 1962 Students' Evening and Conversazione arranged by the **Birmingham Metallurgical Society** each year, and which next year will be held at the College of Advanced Technology, Gosta Green, Birmingham, on February 8.

Following last year's successful event, a large number of companies will exhibit their metallurgical research items, devices, processes and products. Students will exhibit their ideas competitively. These will be apparatus, illustrations, layouts, or written work of a metallurgical nature. Money prizes will be awarded.

The rules relating to the competition for students may be obtained from the secretary to the society—Mr. A. L. Hewer, c/o Brown Bayley Steels Ltd., 21 Bennetts Hill, Birmingham, 2.

Change of Address

Owing to continued expansion and increase of sales, **Fielden Electronics Ltd.** have found it necessary to move their Southern Area office to larger premises at 181-183 Earls Court Road, London, S.W.5. The telephone number of the new office is Freemantle 7866.

Export Order

A three-ton mains frequency induction melting furnace is being despatched by **G.W.B. Furnaces Ltd.** to Precision Alloys Ltd., of Dublin. The furnace, manufactured by G.W.B. to a basic Demag design, is rated at 700 kW and will be used for the melting of special alloy irons.

This furnace is part of an order placed with G.W.B. by the Eire company. Recently, two electric batch furnaces were consigned to Eire, where they will be used for the annealing and general heat-treatment of precision castings. These furnaces each have a heating chamber measuring 7 ft. long, 2 ft. high, 4 ft. 6 in. wide, and are rated at 150 kW, in two independent and automatically controlled zones.

Zinc Die-Casting

Under this heading on page 488 of last week's issue of this journal, reference was made to the English edition of the European Zinc Alloy Die Casting Bulletin. In our note it was stated that the European motor car industry uses some 60,000 zinc die-castings annually. This, of course, should have read "60,000 tons of zinc die-castings annually". We regret the omission of the word "tons".

Aluminium in Australia

More than 127,000 lb. of aluminium sheet and extrusions were used in what is described as "the first large industrial building in Australia clad in aluminium sheet siding and roofing". This building has been constructed at Yennora, New South Wales, for **Comalco Products Pty. Ltd.**, and will house the company's new rolling mill facilities. The mill operations will be an important segment of the aluminium production and fabricating facilities established by Consolidated Zinc and Kaiser Aluminum through their jointly held subsidiary companies.

The architects and contractors of the new building are said to have secured savings in construction costs of some 30 per cent by the use of aluminium roofing and siding, and a structural framing system developed in the U.S.A. by Custom Rolled Corrugated Metals Company (Curoco).

In this "Curoco" framing system, called "Super Span", the aluminium roofing and siding is attached to "Z" bar purlins and girts made of steel, with a tensile strength of 75,000 lb/in^2. Self-tapping screws with integral washer heads were used as fasteners, 18 in. apart, and they were applied by torque wrenches.

Aluminium sheets for both the roof and walls were diamond embossed with a 1½ in. deep rib every 4 in. Comalco extrusions were used for mullions on the front curtainwall and for trim between panels on the other elevations. Copings and other curtainwall accessories were obtained from standard items produced by Kaiser Aluminum and Chemical Corporation for structural applications.

The building is the first of its kind in Australia with a 30 ft. spacing between supporting columns. Our photograph on this page shows how the light weight of aluminium siding simplified materials handling throughout the construction of this building. No hoists were required, since even the largest 42 ft. panels could be carried by two workmen, as shown.

No Merger

An announcement from **The Udylite Corporation** contains the following information:—"L. K. Lindahl, chairman of the board of The Udylite Corporation, has announced that at a meeting of the board of directors of the Corporation on December 12, the board voted to terminate the plans for the merger of the Corporation with Metal and Thermit Corporation. Consequently, such merger plans have been terminated and are at an end."

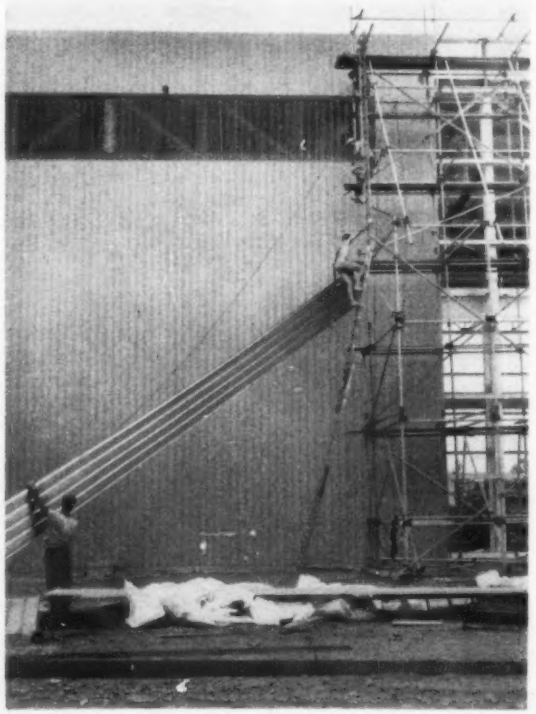
A New Society

A new metallurgical society has been formed in Staffordshire and is to be known as the **Stoke-on-Trent Metallurgical Society.** The officers and committee have been elected, and their names are given on another page in this issue of our journal.

The first lecture meeting of the society will be held at the Town Hall, Hanley, at 7.30 p.m. on January 9 next, when Mr. Tom Grey-Davies will talk on "The Function of a Metallurgical Society". Further particulars may be obtained from the secretary of the society, Mr. B. M. Hardman, North Staffordshire College of Technology, College Road, Stoke-on-Trent.

The Dragon Project

Through their U.K. agents, **Fleischmann (London) Ltd.,** the West German company of W. C. Heraeus G.m.b.H., has received an order for a fuel element assembly line for the gas cooled reactor of the Dragon Project at Winfrith Heath. This order was placed by the U.K.A.E.A. acting on behalf of the O.E.C.D. Dragon Project, an international undertaking in which the U.K.A.E.A., the Euratom countries, Austria, Denmark, Norway,



Aluminium sheet siding and roofing at the new building for Comalco Products at Yennora, N.S.W., Australia

Sweden and Switzerland are participants. The objectives are to achieve major improvements in the field of high temperature gas cooled reactors.

The fuel rods, of approximately 7 ft. in length, are being degassed and then brazed at a high vacuum of 5×10^{-5} mm. Hg. Degassing and brazing temperatures up to 2,000°C. are provided. One fuel element consists of an assembly of seven such rods connected at the top by a graphite block and at the bottom by welded metal cones. The length of a fuel element is approximately 8 ft.

The Heraeus plant, consisting of an interconnected line of glove boxes and various vacuum furnaces, allows the assembling, degassing, brazing and complete testing of the fuel elements under a controlled atmosphere. The boxes are designed to withstand a vacuum.

A G.E.C. Furnace

A vacuum induction melting furnace is now in operation at the Sheffield Laboratories of the British Iron and Steel Research Association. It was supplied by **G.E.C. (Engineering) Ltd.** in association with Vacuum Industrial Applications Ltd., and is being used for research into vacuum melting and casting of ferrous metals, with particular emphasis on the determination of optimum temperatures and pressures necessary for the removal of impurities such as tin, copper and hydrogen. It is also suitable for studying the effect of reduced and elevated pressure on various steelmaking reactions, having been designed for operation at pressures up to 200 lb/in^2. The furnace is capable of working at a maximum temperature of 1,700°C., and has a melting capacity of 10 lb.

Scimitar Cutter

A new cutting torch, incorporating many novel and attractive features, is announced by **Saturn Industrial Gases Ltd.** Named the "Scimitar", the torch is of rugged construction, is well balanced and weighs only 3 lb. For ease of handling, the cutting oxygen lever is fitted underneath a durable ribbed plastics handle. The fuel gas and heating oxygen valves are well spaced to allow easy adjustment by an operator when wearing gloves. These valves, which have no glands, employ captive non-rotating spindles with "O"-seal rings, thus ensuring greater reliability. The gases are mixed in the nozzle, a feature which ensures safe operation, as a back-fire in the torch itself is virtually impossible. The price of the "Scimitar" is £7 10s. 0d., and a full range of two-piece nozzles is available for propane or acetylene at 16s. each.

Accident Prevention in Industry

An extension of training schemes throughout the country next year is the positive answer the accident prevention movement is giving to the current rise in industrial accidents. It is to be hoped that more firms will take advantage of the schemes. This week, the **Birmingham Industrial Accident Prevention Group** opened a new extension to their training centre at Acocks Green, which will play an important part in the 1962 drive.

Welcoming the new extension, Brig. Ralph Stoney, Director General of RoSPA (The Royal Society for the Prevention of Accidents) underlined the magnificent achievements of the group. Among the 2,000 students in 1961, 500 apprentices had passed through the training course (nearly double last year). There were 250 foremen and supervisors (100 increase), 150 crane drivers and slingers (nearly double last year's figure).

New courses include studies on plastics, drop forging and one for insurance engineers. Over the past 20 years, the idea of safety training in industry has become more and more accepted by progressive management as an important contribution to increased productivity, as well as from the welfare aspect.

There has been a variety of courses at Birmingham, including, notably, those for foremen, who are key figures in safety training. There are altogether 58 groups in Great Britain, many of which conduct training through apprentice junior groups.

Silver Brazing Alloys

Five new "Fontargen" silver brazing alloys are now being marketed by **Welding Improvements Limited.** These new products have been developed for specific needs and are as follows:

A 300 — A brazing alloy containing approximately 4 per cent silver. Bonding temperature approximately 750°C. Working temperature about 870°C. Tensile strength is 22/25 tons/in^2.

A 307—A silver brazing alloy with a bonding temperature approximately 570°C. and working temperature 630°C. Tensile strength is 22/25 tons/in^2.

A 310—A silver brazing alloy with a bonding temperature of 560°C. and a working temperature of 620°C. approximately. It is a quasi-eutectic alloy for use where a very small melting range is required. Tensile strength is 22/25 tons/in^2.

A 311—A silver brazing alloy with a bonding temperature of 650°C. and a working temperature of 710°C. approximately. A 311 is cadmium-free and is particularly valuable for cases where the presence of cadmium is objectionable, such as in food and drink preparation. Tensile strength is 22/25 tons/in^2.

A 312—A silver brazing alloy with a very high silver content and additions of nickel and manganese. It is produced in the form of a foil containing a thin central lamination of copper which gives to the joint remarkable elasticity. Specially produced for brazing hard metal inserts where other alloys do not give sufficiently high bond strength. Tensile strength is 22/25 tons/in^2.

These additions make the Fontargen A 300 series of silver alloys comprehensive and very versatile. Other alloys for which they supply low heat metal joining products include special steels, cast iron, stainless steels, copper and its alloys, nickel and its alloys, and the light metals. Fontargen products are exclusively distributed in the U.K. and Eire by this company.

32 Million Feet of Rod

At the annual Christmas party of the **Suffolk Iron Foundry (1920) Ltd.,** held in Ipswich last week, Mr. H. Clarke, assistant managing director of the company, presented a gold watch to Mr. A. "Joe" Sargeant, for his forty years' service with the company, a member of the Qualcast group. Mr. Sargeant has, in his time with S.I.F., made more than 32,000,000 ft. of super silicon cast iron welding rods.

Design Courses

Two further evening courses are being arranged by the School of Welding Technology for designers and draughtsmen in the Manchester and Leeds areas, as follows:

Manchester Course—"Detail Design of Welded Structural Steelwork", January 24 to March 22, 1962. A course for designers and draughtsmen in the structural steelwork industry who wish to acquire the specialized knowledge which is so important in the design of efficient details for welded construction. It deals with the detail design of welded members and joints from the point of view of technical efficiency, ease of fabrication and erection, and cost.

Leeds Course—"Design for Welding", January 24 to March 21, 1962. A general design course applicable to designers and draughtsmen in all branches of engineering who wish to increase their fundamental knowledge about all the factors upon which efficient design for welding depends. The Institute hopes that it will assist industry in the Leeds area to derive maximum benefit from the technical and economic advantages offered by welded construction.

Copies of the prospectuses for both courses may be obtained from the Institute of Welding, 54 Princes Gate, London, S.W.7.

Machine Tool Merger

In furtherance of a scheme to combine the machine tool manufacturing interests of the **Thos. W. Ward Group,** represented by Woodhouse and Mitchell, at Brighouse, and Fredk. Town and Sons Ltd., at Halifax, these businesses have been merged under the name of **Town**

Light Metal Statistics

Figures showing the U.K. production, etc., of light metals for October 1961 have been issued by the Aluminium Industry Council as follows (in long tons) —

Virgin Aluminium		
Production		2,806
Imports		19,116
Despatches to consumers		21,347
Secondary Aluminium		
Production		11,599
Virgin content of above		927
Despatches (including virgin content)		11,153
Scrap		
Arisings		12,886
Estimated quantity of metal recoverable		8,882
Consumption by		
(a) Secondary smelters		12,649
(b) Other uses		790
Despatches of wrought and cast products		
Sheet, strip and circles		15,212
Extrusions (excluding forging bar, wire-drawing rod and tube shell)		
(a) Bars and sections		3,679
(b) Tubes	(i) extruded	288
	(ii) cold drawn	528
	(iii) formed strip.	—
(c) (i) Wire		1,354
(ii) Hot rolled rod (not included in (c) (i)		64
Forgings		346
Castings	(a) Sand	1,703
	(b) Gravity die	4,325
	(c) Pressure die	2,150
Foil		2,294
Paste		412

Woodhouse Ltd. as and from December 31.

The directors of the company are Mr. H. Vernon (chairman), Messrs. G. S. Wood, A. Kissack, E. Town and L. Forbes, and the secretary is Mr. J. Taylor. Mr. Town will be responsible for commercial management and Mr. Forbes for works management and technical development.

The range of the company's manufactures will include centre lathes, milling machines, radial and vertical drilling machines, etc. Manufacture will be continued at the separate works at Halifax and Brighouse under a centralized direction of works control, planning and administration.

Research on Springs

On Thursday, December 7 last, Mr. R. Haynes, director of research of the Spring Manufacturers' Research Association, addressed the **Birmingham Metallurgical Society** on the "Stress-Temperature Relaxation of Springs". Stress relaxation can occur when springs operate at temperatures above normal, the extent of which depends upon time, temperature and the load applied to the spring. Data was given for a number of ferrous and non-ferrous spring materials.

D.S.I.R. Development Contract

The Department of Scientific and Industrial Research has just awarded its first development contract to industry. The contract, valued at a total of about £200,000, has been made with **Craven Brothers (Manchester) Ltd.**, of Stockport, for the development of a large gear grinding machine. Craven Brothers will contribute towards the development costs and also provide the special capital equipment necessary for the manufacture of the machine. The Admiralty is also interested in this project, which is based on earlier research work sponsored by them to meet their particular requirements.

The machine, which will provide a very high degree of accuracy and surface finish, will be designed to handle gears up to 5 ft. in diameter. It should also be capable of grinding gears considerably faster and more accurately than any existing machines. It will incorporate entirely novel mechanical principles and embody some of the latest techniques developed at the National Engineering Laboratory, which, in collaboration with Craven's, will supervise the development on behalf of D.S.I.R.

The whole development, for which Craven Brothers will considerably expand their design and development team, is expected to be complete in three to four years. D.S.I.R. support will cease when the prototype is successfully demonstrated.

It is hoped that this development will lead to a range of fully patented machines capable of grinding gears up to 150 in. in diameter. The project is aimed at the production of highly accurate gears at an economic cost which will enable designers in the medium and heavy engineering fields to provide smaller units operating quietly at higher speeds, and transmitting greater loads with maximum reliability.

News from Birmingham

Little business is likely to be transacted during the next few days. Works will be closed for Christmas, and in the remaining days of the year some firms will carry out stocktaking. Stocks are likely to be heavier this year than they have been in recent years. Conditions have become difficult and the unemployment rate is higher in many of the metal-consuming industries in the area. The shortage of orders for both home and overseas markets has brought considerable anxiety to employers and workers in the rolling stock industry, which not so long ago was a flourishing section of Birmingham's activities; at one firm, the labour force in the last few years has dwindled from 3,000 to about 1,300 and is likely to fall further.

Recent figures of output in the iron and steel trade show that the industry is running at only 79 per cent capacity. Stocks are still high in merchants' and consumers' hands despite the withdrawals of the last few months. In estimating these results, one has to remember that capacity has been greatly increased this year and the industry is still proceeding with major forms of expansion and replacement of obsolete plant, which will again add to capacity in the coming year. In the Midland steelworks, a good demand exists for steel for the building industry. Car manufacturers are taking moderate tonnages, but there is no marked improvement on recent weeks.

Advance Tin Statistics

The International Tin Council announces the following advance statistics on tin: mine production of tin-in-concentrates in the Federation of Malaya rose in October to 4,906 tons from 4,580 tons in September. Bolivian production rose to 1,868 tons in September from 1,594 tons in August. Production in Indonesia dropped to 1,583 tons in September from 1,717 tons in August. Output in the Federation of Nigeria fell from 768 tons in September to 651 tons in October.

Smelter production of tin metal in Malaya and Singapore declined further in October to 5,578 tons from 5,795 tons in September. Production in the United Kingdom dropped to 1,965 tons in October from 2,282 tons in September. Belgian production declined from 538 tons in September to 304 tons in October.

Exports of tin-in-concentrates from Bolivia rose from 1,338 tons in August to 1,975 tons in September. Exports from Indonesia rose to 1,627 tons in August but fell to 1,230 tons in September.

Imports of tin-in-concentrates into Malaya and Singapore rose to 1,938 tons (provisional) in October from 1,344 tons in September. Imports into the United Kingdom increased from 1,099 tons in September to 1,934 tons in October. Imports into the U.S. rose sharply from 375 tons in August to 1,446 tons in September.

Exports of tin metal from Malaya and Singapore rose steeply from 4,959 tons in October to 6,793 tons (provisional) in November. Exports from the U.K. rose from 616 tons in September to 787 tons in October. Exports from the Netherlands increased to 812 tons in October from 659 tons in September.

Imports of tin metal into the U.S. declined slightly from 4,034 tons in August to 3,929 tons in September. Imports into Federal Germany rose slightly in September to 1,136 tons against 1,079 tons in August.

Stocks of tin-in-concentrates in Malaya and Singapore increased from 3,507 tons at the end of August to 3,827 at end-September. Stocks in Bolivia declined to 1,539 tons at end-September from 1,811 tons a month earlier. Stocks of tin metal at official warehouses in the U.K. declined from 4,433 tons at end-October to 4,275 tons at end-November. Stocks with consumers in the U.S. rose substantially from 17,000 tons at end-August to 20,095 tons at end-September. Stocks in Malaya and Singapore fell sharply from 3,714 tons at end-August to 2,077 tons at end-September but rose to 2,690 tons at end-October.

Consumption of primary tin metal in the U.S. dropped from 4,570 tons in August to 4,245 tons in September. Consumption in the U.K. in October—at approximately 1,810 tons—showed little change from the September figure of 1,828 tons.

Aluminium and Welding

With the increasing use of welding as a method of joining aluminium, and the considerable advances that have been made in technique during the past few years, **Alcan Industries Ltd.** have brought up to date, and considerably enlarged, their book "Welding Aluminium", which was last revised in 1958.

Like its predecessors, the new edition makes special reference to the arc-shrouded processes — tungsten inert gas (TIG) and metal inert gas (MIG)—and the tables of procedures, which occupy half the book's 48 pages, apply to these methods. However, space is now given to a description of other welding processes—namely, metallic arc, resistance, ultrasonic, gas, and pressure welding, also brazing and tungsten-arc cutting—and a section has been added explaining the fundamentals of welding aluminium. Other sections deal with: choice of process and alloy; strength of joints; effect of welding on mechanical properties; distortion; inspection of welds; safety precautions; typical applications; and notes on welding technique.

Parliamentary News

Mr. Denis Howell (Lab., Small Heath) attempted in the Commons last week to initiate an emergency debate under Standing Order 9 on what he described as a matter of urgent public importance.

He said that that matter was "the proposed transfer of subsidiary companies by Messrs. Guest, Keen and Nettlefolds and Messrs. Delta Metals Ltd., which would create monopolies in the field of manufacture of brass screws and of brass rod and wire, and which would be against the public interest".

He said that Delta Metals Ltd., had acquired the one company within the last six months. It had acquired 15 companies in that field within the last three years, and if it went through it would create a tremendous monopoly in brass rod and wire for Delta Metals Ltd., and of brass screws for Guest, Keen and Nettelefolds.

As the Government were one of the largest buyers of brass products, it would also create tremendous complications for the taxpayers and, generally speaking, would obviously be against the public interest.

Refusing the request for an emergency debate, the Speaker ruled that it was not in order because there was no ministerial responsibility for the matter.

Metal Market News

THE world copper statistics for November were published at the end of last week but the details are singularly unexceptional, although on the whole far from discouraging. In terms of short tons of 2,000 lb. the details are as follows: inside the United States, production of crude copper was 120,182 tons, compared with 121,699 tons in October. In refined copper production there was also a drop from 145,425 tons to 141,201 tons, while deliveries dropped from 130,364 tons to 122,446 tons. Stocks of refined copper in producers' hands showed an increase of about 860 tons at 77,646 tons. Outside the United States, production followed a similar pattern, for the output of crude copper, at 200,890 tons, was down by 4,000 tons, while in the case of refined copper the fall was 4,100 tons at 172,611 tons. Deliveries of refined copper to consumers amounted to 197,459 tons, which compared with 189,430 tons in October. Stocks of refined copper were somewhat lower, the total at November 30 being 332,894 tons, against 336,451 tons at the end of October. Whether December will bring any dramatic change in the tempo of copper activity on a world basis seems unlikely, but there is likely to be some falling off in consumption at any rate, due to the Christmas shutdown in many countries.

Maybe it was in anticipation of this that the price of copper tailed off badly at the end of the week after rising to £233 5s. 0d. on Tuesday. Actually, on Friday afternoon cash was listed at no more than £229 10s. 0d., a fall of nearly £4 from the top. In the early part of the week the market was quite firm on adverse news from Katanga and fears of strike trouble at Chuquicamata and Noranda. However, influential selling developed and there was probably a measure of hedging by consumers. Values gave way and at the close cash stood at £229 10s. 0d. and three months at £230 5s. 0d., the turnover for the week being 12,600 tons. On balance, cash gained 10s., while three months was 15s. higher. In L.M.E. warehouse stocks, the trend was reversed and a fall of 201 tons occurred, bringing the total down to 15,649 tons. Consumers have shown rather more activity and interest but the volume of business was not impressive.

Tin was rather a disappointing market, the high points of the week, viz. £954 cash and £965 three months, being succeeded by a low of £950 and £960. At the close, cash was up 30s. on balance at £951 10s. 0d., and three months up £2 at £962. The turnover was 1,145 tons. Stocks fell by 70 tons to 4,182 tons. The outlook is uncertain and sentiment is not by any means so bullish as it was some weeks ago. Lead fluctuated slightly from day to day but was unchanged on balance after a turnover of 6,000 tons at £60 12s. 6d. cash and £61 15s. 0d. three months. Warehouse stocks fell by 165 tons to 10,829. In contrast, zinc showed firmness and put on £1 for both positions to close at £71 12s. 6d. cash and £72 15s. 0d. three months. Some 7,350 tons were traded. L.M.E. warehouse stocks dropped by 195 tons to 11,016 tons.

New York

Copper futures were barely steady in fairly active dealings, but mostly switching. Dealers indicated domestic copper offerings for nearby at 31¼ cents/lb. delivered. Export copper was quoted from 29⅜ cents upwards, F.A.S., New York. One important copper seller said his company had sold January copper for export at 30⅛ F.A.S., New York, but he recognized this as a special case. Interest in January copper was reported better by some custom smelters and producers. One leading producer source noted good consumer interest for early January delivery. This source said apparently, consumers have completed their inventory adjustment for the end of year tax considerations and, in view of the uncertainty surrounding Katanga and Chile, are more interested in placing orders for early next year.

November copper statistics were considered favourable by leading trade sources. It is estimated that Union Miniere has built up stocks of copper to take care of long-term contracts. The scrap copper price was general at 25½. Tin was unchanged and quiet. Lead was spotty and zinc quiet.

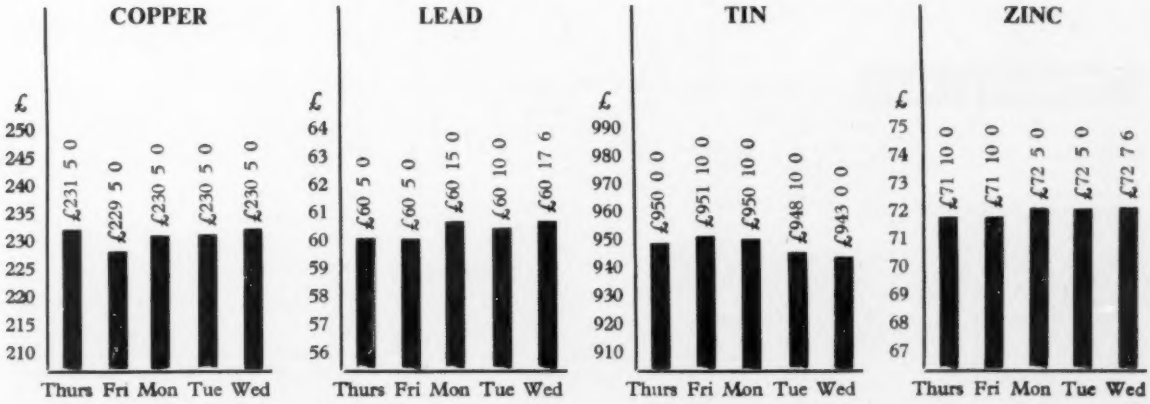
Paris

It was announced last week by the French Official Price Gazette that prices of copper, aluminium and zinc semis, as well as their alloys, can, in future, be established freely between buyers and sellers. Until now, prices of these semis were automatically revised in proportion to rises or falls in the quotations of the French prices of copper, aluminium and zinc.

Copper products fluctuated widely at the week-end, but actual business remained scarce as buyers were waiting to see what developments would emerge from the Katanga conflict. Consumers were also reluctant to operate for seasonal reasons, not wanting to increase stocks before the end-year inventories. Bronze and brass were quiet and aluminium scrap was a routine market. There was some demand for zinc, while lead prices tended to ease.

London Metal Exchange

Thursday 14 December to Wednesday 20 December 1961



C

NON-FERROUS

PRIMARY METALS

All prices quoted are those available at 2 p.m. 20/12/61

		£	s.	d.
Aluminium Ingots	ton	186	0	0
Antimony 99·6%	„	237	10	0
Antimony Metal 99%	„	230	0	0
Antimony Oxide Commercial	„	194	10	0
Antimony White Oxide	„	212	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		11	6
Calcium	„	2	0	0
Cerium 99%	„	18	0	0
Chromium	„		6	11
Cobalt	„		12	0
Columbite per unit			7	10
Copper H.C. Electro	ton	230	5	0
Fire Refined 99·70%	„	229	0	0
Fire Refined 99·50%	„	228	0	0

		£	s.	d.
Copper Sulphate	ton	78	0	0
Germanium	grm.		—	
Gold	oz.	12	10	11½
Indium	„		10	0
Iridium	„	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	60	17	6
Magnesium Ingots	lb.			
99·8%	„		2	2½
99·9+%	„		2	3
Notched Bar	„		2	9½
Powder Grade 4	„		5	6
Alloy Ingot. AZ91X		1	11½-2	1½
Manganese Metal	ton	280	0	0
Mercury	flask	59	0	0
Molybdenum	lb.	1	15	0
Nickel	ton	660	0	0
F. Shot	lb.		5	11
F. Ingot	„		5	11
Osmium	oz.	20	0	0
Osmiridium	„		—	

		£	s.	d.
Palladium	oz.	9	0	0
Platinum	„	30	5	0
Rhodium	„	46	0	0
Ruthenium	„	16	0	0
Selenium	lb.	2	1	0
Silicon 98%	ton	123	0	0
Silver Spot Bars	oz.		7	2¾
Tellurium Sticks	lb.	2	0	0
Tin	ton	943	0	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	72	13	9
Dust 95/97%	„	112	0	0
Dust 98/99%	„	118	0	0
Granulated 99+%	„	97	13	9
Granulated 99·99+%	„	109	5	0

**Duty and Carriage to customers' works for buyers' account.*

INGOT METALS

All prices quoted are those available at 2 p.m. 20/12/61

Aluminium Alloy (Virgin)	£	s.	d.
B.S. 1490 L.M.5 ton	nom.		
B.S. 1490 L.M.6 „	„		
B.S. 1490 L.M.7 „	„		
B.S. 1490 L.M.8 „	„		
B.S. 1490 L.M.9 „	„		
B.S. 1490 L.M.10 „	„		
B.S. 1490 L.M.11 „	„		
B.S. 1490 L.M.12 „	„		
B.S. 1490 L.M.13 „	„		
B.S. 1490 L.M.14 „	„		
B.S. 1490 L.M.15 „	„		
B.S. 1490 L.M.16 „	„		
B.S. 1490 L.M.18 „	„		
B.S. 1490 L.M.22 „	„		
Aluminium Alloys (Secondary)			
B.S. 1490 L.M.1 ton	144	0	0
B.S. 1490 L.M.2 „	145	0	0
B.S. 1490 L.M.4 „	154	0	0
B.S. 1490 L.M.6 „	170	0	0
***Aluminium Bronze**			
BSS 1400 AB.1 ton	240	0	0
BSS 1400 AB.2 „	247	0	0

***Brass**	£	s.	d.
BSS 1400-B3 SCB2 ton	177	0	0
BSS 249 „	173	0	0
***Gunmetal**			
B.S. 1400: LG2 d/d „	213	0	0
B.S. 1400: LG3 d/d „	223	0	0
B.S. 1400: GI 1½ Pb d/d „	278	0	0
B.S. 1400: GI ½ Pb d/d „	295	0	0
***Manganese Bronze**			
BSS 1400 HTB1 „	192	0	0
BSS 1400 HTB2 „	212	0	0
BSS 1400 HTB3 „	226	0	0
Nickel Silver			
Casting Quality 12% „	257	0	0
„ „ 16% „	267	0	0
„ „ 18% „	312	0	0
***Phosphor Bronze**			
B.S.1400P.B.1.(A.I.D. released) „	314	0	0
B.S. 1400 L.P.B.1 „	235	0	0

**Average prices for the last week-end.*

Phosphor Copper	£	s.	d.
10% ton	253	0	0
15% „	256	0	0
Phosphor Tin			
5% „	1030	0	0
Silicon Bronze			
BSS 1400-SB1 „	280	0	0
Solder, soft, BSS 219			
Grade C Tinmans „	423	10	0
Grade D Plumbers „	334	15	0
Grade M „	468	0	0
Solder, Brazing, BSS 1845			
Type 8 (Granulated) lb.		—	
Type 9 „		—	
Zinc Alloys			
BSS 1004 Alloy A ton	102	15	0
BSS 1004 Alloy B „	106	15	0
Sodium-Zinc lb.		2	6

SCRAP METALS

Merchants' average buying prices delivered, per ton, 19/12/61

Aluminium	£
New Cuttings	134
Old Rolled	97
Segregated Turnings	72
Brass	
Cuttings	155
Rod Ends	141
Heavy Yellow	132
Light	127
Rolled	142
Collected Scrap	129
Turnings	133

Copper	£
Wire	206
Fireboz, cut up	204
Heavy	198
Light	193
Cuttings	209
Turnings	191
Braziery	164
Gunmetal	£
Gear Wheels	198
Admiralty	198
Commercial	176
Turnings	171

Lead	£
Scrap	49
Nickel	
Cuttings	—
Anodes	590
Phosphor Bronze	
Scrap	176
Turnings	171
Zinc	
Remelted	62
Cuttings	47
Old Zinc	30

METAL PRICES

SEMI-FABRICATED PRODUCTS

Prices vary according to dimensions and quantities. The following are the basic prices for certain specific products

		£	s.	d.
Aluminium				
Sheet 10 S.W.G.	lb.		2	10½
Sheet 18 S.W.G.	,,		3	0½
Sheet 24 S.W.G.	,,		3	3½
Strip 10 S.W.G.	,,		2	10½
Strip 18 S.W.G.	,,		2	11½
Strip 24 S.W.G.	,,		3	1
Circles 22 S.W.G.	,,		3	4½
Circles 18 S.W.G.	,,		3	3½
Circles 12 S.W.G.	,,		3	2½
Plate as rolled	,,		2	10
Sections	,,		3	4
Wire 10 S.W.G.	,,		3	1½
Tubes 1 in. o.d. 16 S.W.G.	,,		4	4
Aluminium Alloys				
BS 1470. HS19W.				
Sheet 10 S.W.G.	,,		3	3
Sheet 18 S.W.G.	,,		3	5½
Sheet 24 S.W.G.	,,		4	1
Strip 10 S.W.G.	,,		3	3
Strip 18 S.W.G.	,,		3	4½
Strip 24 S.W.G.	,,		4	0½
BS1477. HP30M.				
Plate as rolled	,,		3	1
BS1470. HC15WP.				
Sheet 10 S.W.G.	,,		4	3
Sheet 18 S.W.G.	,,		4	8½
Sheet 24 S.W.G.	,,		5	8½
Strip 10 S.W.G.	,,		4	4
Strip 18 S.W.G.	,,		4	8½
Strip 24 S.W.G.	,,		5	4½

		£	s.	d.
Aluminium Alloys—cont.				
BS1477. HPC15WP.				
Plate heat treated	lb.		3	10½
BS1475. HG19W.				
Wire 10 S.W.G.	,,		4	2
BS1471. HT19WP.				
Tubes 1 in. o.d. 16 S.W.G.	,,		5	5
BS1476. HE19WP.				
Sections	,,		3	4
Split tube				
19 S.W.G. (¼")	,,		4	2
20 S.W.G. (⅜")	,,		3	11
21 S.W.G. (⅛")	,,		4	1
22 S.W.G. (¼")	,,		4	11
Welded tube 14 to 20 S.W.G. (sizes ½" to 1½")	,,	3/5½ to 5/5		
Brass				
Tubes	lb.		1	9¾
Brazed Tubes	,,		3	1⅜
Drawn Strip Sections	,,		3	1⅜
Sheet	ton	198	10	0
Strip	,,	198	10	0
Extruded Bar	lb.		2	0¼
Condenser Plate (Yellow Metal)	ton	184	0	0
Condenser Plate (Naval Brass)	,,	198	0	0
Wire	lb.		2	8⅜

		£	s.	d.
Beryllium Copper				
Strip	lb.	1	4	11
Rod	,,	1	1	6
Wire	,,	1	4	9
Copper				
Tubes	lb.		2	3⅛
Sheet	ton	266	0	0
Strip	,,	266	0	0
H.C. Wire	,,	281	5	0
Cupro Nickel				
Tubes 70/30	lb.		3	8¾
Lead				
Pipes (London)	ton	102	10	0
Sheet (London)	,,	100	5	0
Tellurium Lead	,,	£6 extra		
Nickel Silver				
Sheet and Strip 10%	lb.		3	11½
Wire 10%	,,		4	4¾
Phosphor Bronze				
Wire	,,		4	2½
Titanium (1,000 lb. lots)				
Billet 4½" to 18" dia.	lb.	47/-		48/-
Rod ¼" to 4" dia.	,,	85/-		53/-
Wire ·036"·232" dia.	,,	159/-		99/-
Strip ·001" to ·048"	,,	350/-		68/-
Sheet 8'×2'. 20 gauge	,,	73/-		
Tube, representative average gauge	,,	198/-		
Extrusions	,,	90/-		
Zinc				
Sheet	ton	110	5	0
Strip	,,	nom.		

FOREIGN QUOTATIONS

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

Belgium	fr/kg	£/ton
Copper: electrolytic	31.75	232 1
Tin	134.20	980 17

Canada	c/lb	£/ton
Aluminium	24.00	194 8
Copper: electrolytic	30.00	243 0
Lead	10.00	81 0
Nickel	82.50	668 5
Zinc: Prime western	11.50	93 3
High grade 99.95	12.10	98 0
High grade 99.99	12.50	101 5

France	fr/kg	£/ton
Aluminium	2.43	179 11
Antimony 99·0	2.80	206 18
Cadmium	16.75	1,247 16
Copper: electrolytic	3.21	237 4
Lead	.90	66 10
Nickel	9.00	665 2
Tin	13.70	1,012 8
Zinc: Thermic	1.07	79 1
Zinc: electrolytic	1.15	85 0
Scrap		
Copper: electrolytic	2.80	210 12
Heavy copper	2.80	210 12
No. 1 copper wire	2.75	205 8
Brass rod ends	2.15	160 7
Zinc castings	.85	62 16
Lead	.82	60 11
Aluminium	1.80	133 0

Italy	lire/kg	£/ton
Aluminium	370	216 1
Antimony 99·0	470	274 9
Copper: wire bars 99·9	445	259 17
Lead	155	90 10
Nickel	1,300	805 14
Tin	1,840	1,074 11
Zinc: electrolytic	165	96 7
Scrap		
Aluminium soft sheet clippings (new)	290	169 7
Lead, soft, first quality	130	75 18
Lead, battery plates	74	43 4
Copper, first grade	370	216 1
Bronze, commercial gunmetal	420	245 7
Brass: heavy	270	157 13
Brass: light	255	148 18
Brass, bar turnings	265	154 15
Old zinc	93	54 6

Switzerland	fr/kg	£/ton
Aluminium	2.50	210 5
Copper: electrolytic	2.88	242 4
Lead	.80	67 5
Nickel	7.68	645 17
Tin	11.68	982 5
Zinc: High grade 99.99	.98	82 8

Japan	Yen per metric ton
Scrap	
Copper: electrolytic	268,000
Copper wire No. 1	240,000
Copper wire No. 2	225,000
Heavy copper	233,000
Light copper	213,000
Brass, new cuttings	175,000
Red brass scrap	215,000

West Germany *Scrap*	D-marks per 100 kilos	£/ton
Used copper wire	220	200 8
Heavy copper	220	200 8
Light copper	185	168 10
Heavy brass	150	136 13
Light brass	110	100 5
Soft lead	50	45 11
Zinc	48	43 14
Used aluminium unsorted	90	82 0

United States	c/lb	£/ton
Aluminium	24.00	191 5
Antimony 99·0	32.50	259 0
Cadmium	160.00	1,275 4
Copper: electrolytic	31.00	247 10
Lead	10.00	79 14
Nickel	82.34	656 4
Tin	123.00	980 12
Zinc: electrolytic	12.50	99 6

THE STOCK EXCHANGE

Better Support For Industrials

ISSUED CAPITAL •	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 18 DECEMBER +RISE—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1961 HIGH	1961 LOW	1960 HIGH	1960 LOW
£	£			Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	29/9	11	9	7 8 0	33/9	26/3	35/-	26/6
400,000	2/-	Anti-Attrition Metal	1/3	NIL	4	NIL	1/3½	0/9	1/6	0/9
43,133,663	Stk. (£1)	Associated Electrical Industries ...	28/6 —6d.	15	15	10 10 6	54/10½	28/3	67/3	38/3
3,895,963	1	Birfield	61/6xd —4/-	10	15‡	3 5 0	78/9	45/-	51/3	29/-
4,795,000	1	Birmid Industries	61/3	20	20	6 10 6	103/-	60/6	74/9	56/-
8,445,516	Stk. (10/-)	Birmingham Small Arms	18/- —9d.	11½	11½K	6 9 0	36/10½	17/3	30/6	18/3
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5% ...	13/6 +6d.	5	5	7 8 3	14/6	12/3	17/4½	14/9
476,420	Stk. (£1)	Ditto Cum. B. Pref. 6%	17/- +6d.	6	6	7 1 2	17/6	15/4½	20/-	17/1½
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6% ...	16/-	6	6	7 10 0	18/-	15/3	21/1½	17/7½
21,737,634	Stk. (£1)	British Insulated Callender's Cables	55/9	13½	13½	4 16 9	62/3	49/-	61/4½	47/-
30,683,348	5/-	British Oxygen Co. Ltd., Ord. ...	15/3	16D	16	3 10 0	28/4½	14/-	35/-	19/10½
1,200 000	Stk (5/-)	Canning (W.) & Co.	14/6 —3d.	15½	25+*2½C‡	5 8 9	20/9	13/7½	19/9	13/7½
60,484	1/-	Carr (Chas.)	1/4½	NIL	NIL	—	1/7½	10½d.	2/3	1/-
550 000	1	Clifford (Chas.) Ltd.	27/9	12	10	8 13 0	31/-	26/-	35/-	28/9
45,000	1	Ditto Cum. Pref. 6%	15/-	6	6	8 0 0	15/3	15/-	16/-	15/10½
1,166,000	Stk. (2/-)	Clifford Components V	8/-	25*2½C	25*2½C	6 5 0	10/1½	7/3	11/9	6/10½
300,000	2/-	Coley Metals	2/10½ +4½d.	15	15	10 8 9	4/5½	2/6	5/-	3/4½
10,185,696	1	Cons. Zinc Corp.†	48/- +1/3	20 O	15	8 6 9P	81/6	46/-	80/9	59/6
5,399,056	5/-	Davy-Ashmore	32/- +1/-	27½	22½	4 6 0	44/6	29/-	147/3	99/6
8,995,011	5/-	Delta Metal	21/3 +4½d.	20	17½	4 14 0	27/7½	19/-	28/3	18/6
5,296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	37/- +1/-	15	15	8 2 3	52/3	35/3	56/9	45/-
1,155,000	1	Evered & Co.	42/-	10	10ôB	4 15 3	45/9	42/-	42/9	29/3
23,000,000	Stk. (£1)	General Electric Co.	23/3 —6d.	10	10	8 12 0	39/6	23/3	47/9	29/-
1,500,000	Stk. (10/-)	General Refractories Ltd.	47/3 +1/-	25	20	5 5 9	65/-	42/9	52/6	40/-
937,500	5/-	Glacier Metal Co. Ltd.	21/9	15	13	3 9 0	22/-	13/9	16/1½	11/1½
2,750,000	5/-	Glynwed Tubes	25/9 +6d.	22½	25¶	4 7 6	30/3	22/6	27/6	17/-
7,228,065	10/-	Goodlass Wall & Lead Industries ...	32/- +6d.	15	19L	4 13 9	44/9	28/-	41/9	33/-
696,780	10/-	Greenwood & Batley	15/6 —6d.	15	30‡	9 13 6	29/6	14/3	33/6	29/1½
792 000	5/-	Harrison (B'ham) Ord.	8/3 —3d.	*10	*20‡	6 1 3	14/6	8/3	15/10½	11/9
150,000	1	Ditto Cum. Pref. 7%	17/9	7	7	7 17 9	20/4½	17/7½	23/6	22/-
1,651,250	5/-	Heenan Group	14/3	13	11½K	4 11 3	17/1½	10/6	13/-	9/10½
266,608,683	Stk. (£1)	Imperial Chemical Industries ...	55/9 —1/9	13½	11½	5 0 6	81/6	55/4½	76/6	54/-
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	14/-xd	5	5	7 2 9	16/-	13/10½	18/-	15/4½
29,196,118	••	International Nickel	144½ +1½	$1.60	$1.50	1 17 6	160	104	105	84½
6,000,000	1	Johnson, Matthey & Co.	83/6	15	12	3 11 9	86/3	57/6	67/6	44/9
600,000	10/-	Keith, Blackman	17/6 +6d.	17½	17½E	10 0 0	21/6	16/6	32/6	17/6
320,000	4/-	London Aluminium	9/9	N	13	—	15/-	8/6	12/6	7/10½
2,667,542	1	McKechnie Bros. A Ord.	31/9 —9d.	11½K	17½	7 7 6	53/3	31/3	69/3	55/-
1,108,268	5/-	Manganese Bronze & Brass	9/6	20½	20½	10 10 0	18/6	8/3	18/6	13/4½
50,628	6/-	Ditto (7½% N.C. Pref.)	5/-	7½	7½	9 0 0	6/-	5/-	6/6	5/9
26,361,444	Stk. (£1)	Metal Box	83/- +5/6	12	12M	2 17 9	100/9	68/3	84/3	61/-
415,760	Stk. (2/-)	Metal Traders	5/-	25	50H	10 0 0	8/9	4/9	10/9	7/1½
240,000	1	Mint (The) Birmingham	37/-	15G	12½	5 8 0	37/-	24/-	39/-	33/6
80,000	5	Ditto Pref. 6%	70/-	6	6	8 11 6	77/6	70/-	80/-	75/-
274,152	1/-	Minworth Metals	4/9	30	30S	6 6 3	6/3	4/6½	5/2½	3/10½
5,187,938	Stk. (£1)	Morgan Crucible A	56/9 —6d.	14	13	4 18 9	71/3	53/4½	63/-	47/6
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	15/6	5½	5½	7 2 0	17/-	13/10½	18/9	15/9
3,850,000	Stk. (£1)	Murex	40/3	13	22½J	6 9 3	52/-	36/9	45/-	35/3
585,000	5/-	Ratcliffs (Great Bridge) Ord. ...	15/6	10	10R	3 4 6	16/6	15/6	17/-	14/9
1,064,880	10/-	Sanderson Kayser	34/6	17½	35‡	5 1 3	41/3	29/-	40/3	27/7½
3,400,500	Stk. (5/-)	Serck	13/4½ +4½d.	12½	12½	4 13 6	19/3	12/2½	25/6	15/3
212,384	5/-	Stedall & Co.	7/3 —3d.	15	15	10 7 0	10/3	7/3	10/3	6/3
8,035,372	Stk. (£1)	Stone-Platt Industries	43/9 +1/3	16 O	15	7 6 3W	67/-	37/6	64/4½	52/3
2,928 963	Stk. (£1)	Ditto 5½% Cum. Pref.	14/-	5½	5½	7 17 3	18/-	13/6	18/7½	15/3
35,344,881	Stk. (£1)	Tube Investments Ord.	62/6 +3/6	14	18½	4 9 6	85/6	54/-	140/3	63/10½
41,000,000	Stk. (£1)	Vickers	27/6 +1/-	10	10	7 5 6	38/3	25/6	39/7½	27/1½
750,000	Stk. (£1)	Ditto Pref. 5%	13/- —6d.	5	5	7 13 9	15/-	12/4½	17/6	13/3
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	19/-	*5	*5	7 16 6A	21/1½	18/-	24/6	20/1½
4,594,418	1	Ward (Thos. W.) Ord.	59/6	13½	13½	4 12 6	84/6	58/-	94/-	63/-
7,109,424	Stk. (£1)	Westinghouse Brake	23/- —6d.	11	10	9 11 3	46/3	23/-	60/6	37/6
323,773	2/-	Wolverhampton Die-Casting ...	6/-	30	35	10 0 0	13/4½	6/-	13/10½	8/1½
591,000	5/-	Wolverhampton Metal	21/6 —3d.	32½	32½	7 11 6	30/-	19/6	39/9	23/9
156,930	2/6	Wright, Bindley & Gell	4/10½ +3d.	15	15	7 13 9	5/-	3/7½	4/6	2/10½
124,140	1	Ditto Cum. Pref. 6%	12/6	6	6	9 12 0	13/7½	12/6	15/-	13/6
150.000	1/-	Zinc Alloy Rust Proof	4/1½ —1½d.	40	30	9 14 0	5/6	4/-	5/4½	4/-

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡and 100% capitalized issue. •The figures given relate to the issue quoted in the third column. A Calculated on £7 8 9 gross. D and 50% capitalized issue. C paid out of Capital Profits. E and 50% capitalized issue in 7% 2nd Pref. Shares. R and 33⅓% capitalized issue in 8% Maximum Ordinary 5/- Stock Units. ϕ and 6¼% from Capital Profits. B and 50% capitalized issue. G and 50% capitalized issue. F and special 5% tax free dividend and 50% capitalized issue. ¶and 3 for 7 capitalized issue. L and 33⅓% capitalized issue. M and 10% capitalized issue. J and 75% capitalized issue. Q also 1/- special tax free dividend and 50% capitalized issue. T Per £1 unit. K 50% capitalized Issue allowed for. S and 50% capitalized issue. V incorporating Clifford Covering. H including bonus 12½%. N current interim dividend passed. O current interim reduced. P calc. at 20%. W calc. at 16%.

Flawless

No, we shall not be silly and claim that our castings are as flawless as a piece of 16th century Venetian Glass. But we can go this far: we can say that just as the old master craftsmen got great satisfaction out of doing a job as well as it could possibly be done, so do we. That is why so many customers whose castings must have a fine skin which will readily anodise put their trust in Great Bridge Foundries

PRECISION CASTINGS IN ALUMINIUM, GUN METAL, GREY IRON, ETC. TO ALL SPECIFICATIONS

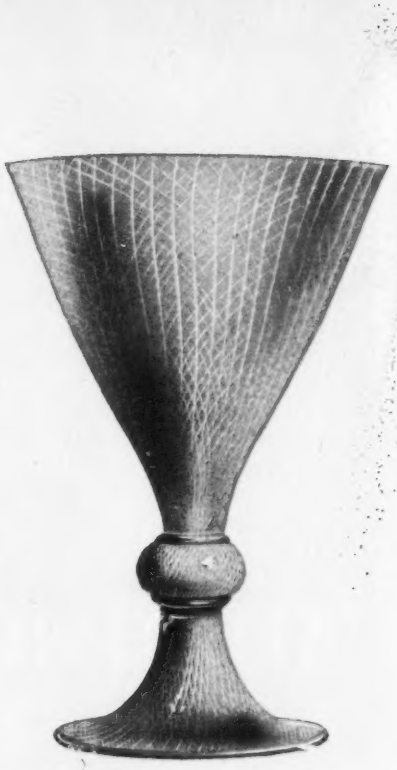
Phos. bronze and gun metal solid and cored sticks always in stock

THE GREAT BRIDGE FOUNDRY CO. LTD.

Sheepwash Lane Great Bridge - Tipton
Staffordshire Telephone: TIPton 2914/5/6

A Member of the Triplex Foundries Group

THE SIGN OF A GOOD CASTING



Q88

SCRAP *Metal*

J. B.
GARNHAM
& SONS LIMITED

PLANTATION HOUSE MINCING LANE
LONDON E.C.3

Phone MINCING LANE 8424
Grams GARNHAM · PHONE · LONDON
Cables GARNHAM · LONDON · E.C.3

LION WORKS, FOX OAK STREET, CRADLEY HEATH, STAFFS.
Telephone No.: CRADLEY HEATH 69281

ESTABLISHED 1867

MAGNESIUM ELEKTRON LIMITED

for all

MAGNESIUM ALLOYS

MEL

Magnesium Elektron Limited

Clifton Junction Manchester *Swinton 2511*
London Office: 5 Charles II Street SW1
Trafalgar 1646
Magnesium Elektron, Inc., New York 20 USA

NON-FERROUS METALS RESIDUES SCRAP

Manufacturers of

GUNMETAL & BRONZE
INGOTS, CHILL BARS
CONTINUOUS CAST BARS
etc.

BROOKSIDE METAL Co., LTD

OWNED BY METAL TRADERS LTD.

BY-PASS ROAD, WATFORD, HERTS.

Tel: WATFORD 26474 (10 lines). Telex No: 28457.

Branch Works:

GROVELAND ROAD, DUDLEY PORT, TIPTON, STAFFS.
Tel: Tipton 2114 Telex No: 33410

ST. NINIAN'S ROAD, LINLITHGOW, SCOTLAND.
Tel: Linlithgow 246

The **nickel anodes** you want are only a phone call away

Deutsch and **Brenner** Limited

can give **immediate delivery** of **every type** of **nickel anode**

CARBON · DEPOLARISED ELECTROLYTIC · CAST ROLLED

Also Anodes in all other metals
CADMIUM · COPPER · LEAD · TIN · ZINC · etc.

DEUTSCH & BRENNER Limited
HARFORD ST. BIRMINGHAM 19
Telegrams AMICABLE B'HAM

BIRMINGHAM NORshorn 3038 (11 lines) Telex 33-374 CARDIFF 31833
MANCHESTER Blackfriars 9630

BOLTON'S

ROTOR & STATOR END-RINGS

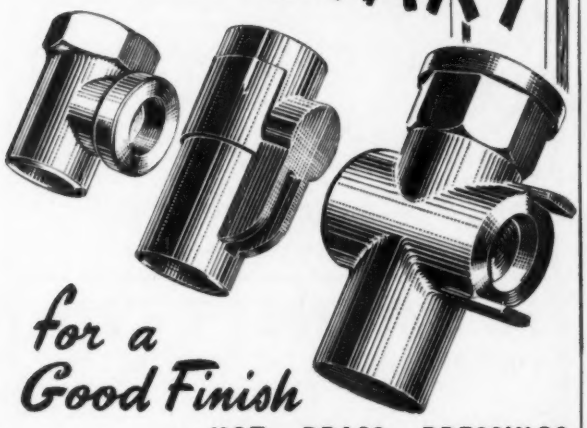
A NEW DEVELOPMENT

A recent development enables us to offer copper rolled end-rings, rolled as rings, up to 7 feet diameter, as illustrated.

Made in certain alloys having electrical properties which make them suitable for special purposes, and are supplied in high conductivity copper, arsenical copper, or aluminium-bronze. Machined from cold or hot rolled plate up to 7 feet diameter.
For special purposes end-rings can be supplied from machined castings in H.C. copper up to 7 feet diameter and 1½ tons in weight.

THOMAS BOLTON & SONS LTD
Head Office: MERSEY COPPER WORKS, WIDNES, LANCS.
Telephone: Widnes 2022 Telegrams: "Rolls, Widnes".
London Office & Export Sales Department: 168 Regent St., W.1.
Telephone: Regent 6427. Telegrams: "Wiredrawn, Piccy, London".

A FINE START



for a Good Finish

HOT BRASS PRESSINGS
for GAS, WATER and ELECTRICAL FITTINGS and GENERAL ENGINEERING TRADES

by

ASSOCIATED PRESSINGS LIMITED
SPRINGCROFT ROAD, BIRMINGHAM 11

RHONDDA METAL
COMPANY LIMITED

RHONDDA WORKS
PORTH GLAM.
SOUTH WALES

Phone PORTH 280
Cables RONDAMET PORTH

London Office:—
25 UPPER BROOK ST W.1.

Phone HYDE PARK 4010
Cables RONDAMET LONDON
Telex LON 28543

ALUMINIUM BRONZE
PHOSPHOR BRONZE
LEAD BRONZE
GUNMETAL
BRASS
PHOSPHOR COPPER
SILICON COPPER
MANGANESE COPPER

METALS & ORES

SCRAP & RESIDUES

METAL DISTRIBUTORS (U.K.) LIMITED.

BARRINGTON HOUSE, 59-67 GRESHAM ST., LONDON E.C.2.

Tel: Monarch 0463. Telex London 23809.
Cables: Metdist London

Associates in Trade and Industry throughout India

BUSHES and BEARINGS

From ½" Solid to
4" Solid or Cored

ALSO

Centrifugal Cast and Chill Cast

Range of sizes from ½" solid to 11½" cored

★ *100% fault free*
★ *Any length up to 6 ft.*
★ *Super finish and quality*
★ *Dimensional accuracy*

Send today for full details

THE EYRE SMELTING CO. LTD.

Also makers of TANDEM WHITE METALS & ESCO GUN METAL INGOTS, etc.

TANDEM WORKS, MERTON ABBEY, LONDON SW19 Tel: Mitcham 2031

THE THREADGILL ELECTRO DEPOSITS LTD.

THE THREADGILL BRAND

Manufacturers of
TINPLATES and ZINC SHEETS BRASSED, COPPERED and NICKEL PLATED. Also CHROMIUM PLATED GUARANTEED NOT TO STRIP FLEXIBLE FOR DEEP DRAWING etc.

N.B. Users of THESE PRODUCTS will save by testing our SAMPLES which will be gladly sent on receipt of letter, or 'phone TIPTON 1151/2. PROMPT deliveries, GUARANTEED WORK and strictly competitive prices.
RELIANCE WORKS, UNION STREET, TIPTON, STAFFS

H. BARNETT LTD.

VICTOR ROAD, LONDON, N.7
(ESTAB. 1865.)

SPECIALIZE IN
NON-FERROUS SCRAP METALS

Selected Brass, Copper, Gunmetal and Aluminium Scrap, carefully prepared for foundries.

TEL: ARCHWAY 5461 (5 LINES)

a study of British industries & the opportunities they offer

INDUSTRY & CAREERS

Compiled with the official support of leading industrial and educational organisations: Foreword by H.R.H. The Duke of Edinburgh. General Editor D. E. Wheatley MA BSc

Here for the first time is a completely up-to-date and scientific approach to the problem of choice of career. INDUSTRY AND CAREERS not only provides a treatment based on new ideas, but is unquestionably the most up-to-date and comprehensive book of its kind. Each industry is first analysed in great detail, and then – against this background which is essential for a thorough understanding – the career prospects and the necessary educational qualifications are examined. The product of five years' research and study, supervised by a distinguished Editorial Advisory Committee it fills what has long been recognised as a serious gap. A striking feature of the book is the extensive use of charts. These have been introduced to show typical paths of promotion in various industries, to clarify systems of organisation and to depict the sequence of operations in industrial processes. With many striking photographs there are altogether 96 pages of illustrations.
INDUSTRY AND CAREERS will become the standard work of reference in its field – the most influential and comprehensive guide for young people making the crucial decision of their lives, and for those responsible for advising them.

obtainable from leading booksellers

55s net by post 57s 6d 872 pp

a new comprehensive and scientific treatment of the problem

Published by **ILIFFE Books Ltd.,** Dorset House, Stamford Street, London, S.E.1

Copper, Brass and Aluminium in Sheets, Tubes, Rods and Wire

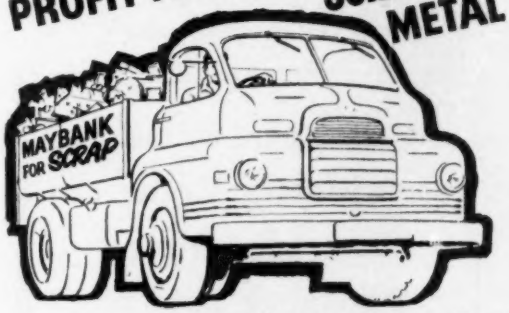
DELIVERIES FROM STOCK

T. W. YOUNG LTD.

105 GOSWELL ROAD, E.C.1

Phone: Clerkenwell 2241/2 Grams: Wuzog, Barb.

PROFIT FROM YOUR SCRAP METAL



Contact the buyers of non-ferrous scrap metals.

Ask for Mr. Neal at:

MAYBANK METALS LTD

108, WOOTTON STREET, WATERLOO, LONDON, S.E.1.
Tel.: WATERLOO 4110, 7355

ONE OF THE

MAYBANK

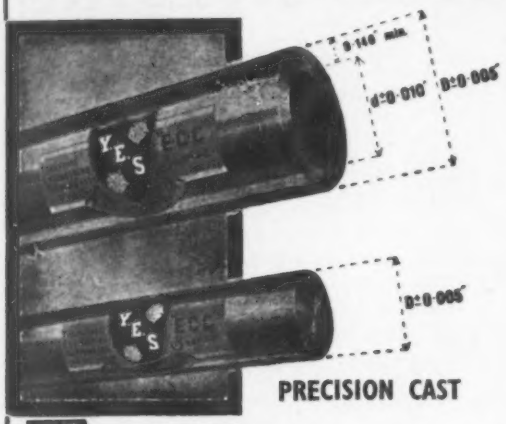
GROUP OF COMPANIES

Branches at: Higginshaw, Portsmouth, Edmonton, Gosport Deptford, Woolwich, Stroud, Waterlee

Y.E.S—E.C.C

CAST BRONZE BARS

10 to 12 FEET LONG FOR MACHINING ON BAR AND AUTOMATIC MACHINES



PRECISION CAST

Yorkshire Engineering Supplies Ltd.

BRONZE FOUNDRIES
LEEDS · 12

Telephone: 630571 (4 lines) Telegrams: Yes, Leeds 12

M. JOSEPH & SON (BIRMINGHAM) LTD

10-12 BARD ST
SHAKESPEARE ST
SPARKHILL
BIRMINGHAM 11

Telephone:
VICTORIA 2264-5-6

METAL MERCHANTS & MANUFACTURERS

Buyers & Sellers of all Grades

NON-FERROUS METALS AND RESIDUES

Prompt settlement
Collections and Deliveries

MEMBER OF THE NATIONAL ASSOCIATION OF NON-FERROUS SCRAP METAL MERCHANTS

Non-Ferrous Metals

TO CLOSE TOLERANCES

Copper, Brass
Gilding Metal
Cartridge Metal
Phosphor Bronze
Zinc, etc,

In long continuous coils or strips cut to length.

HALL STREET METAL ROLLING

COMPANY LIMITED

WESTERN ROAD, BIRMINGHAM, 18.

A MEMBER OF THE CHARLES CLIFFORD GROUP

TUBES FOR THIS—AND TUBES FOR THAT

MANUFACTURERS OF SMALL BRASS AND COPPER

TUBES

ASTON TUBES (NON-FERROUS) LTD.

26/38 WAINWRIGHT STREET, BIRMINGHAM 6
Telegrams: "Astube B'ham 6" *Telephone:* EAST 0236

LONDON OFFICE, 179-181, Vauxhall Bridge Road, London, S.W.1
Telephone: Tate Gallery 8843 and Victoria 5705

NORTHERN OFFICE, North Eastern Chambers, Station Square, Harrogate
Telephone: Harrogate 67247

5721

T. J. BROOKS & Co.

(METALS) LTD.

Buyers of Scrap Metals

ALUMINIUM · BRASS · COPPER · GUNMETAL
PHOSPHOR BRONZE · MANGANESE BRONZE
CONDENSER TUBES · OLD PROPELLERS
LEAD · WHITEMETALS

Works and Offices

CROW LANE, ROMFORD, ESSEX

Telephone: ROMford 43113 ROMford 49447 Telegrams: Goblons, Romford

Classified Advertisements

Rate: Advertisements set in run-on style **5d.** per word, minimum 5/-. Semi-displayed announcements are charged at **27/6** per inch depth. Box Numbers: add 5 words, plus 1/- for registration and forwarding replies. "Copy" accepted at London Office up to 1st post on each Friday for the following Friday's issue.

Series Discounts: Details upon application to "Metal Industry," Dorset House, Stamford Street, London, S.E.1. Remittances payable to "Metal Industry". The proprietors retain the right to refuse or withdraw "copy" at their discretion and accept no responsibility for matters arising from clerical or printers' errors.

APPOINTMENTS VACANT

PRODUCTION Manager required for Foundry in N.W. London, the essential requirements being age limit 30-40, an engineering background and ability to plan production. Some knowledge of time and motion study an advantage. This appointment provides scope for man with energy, drive and initiative. When replying please give brief details of education, experience and salary required. Our own staff have been informed of this advertisement. Box 4382, c/o Metal Industry [8427

CAPACITY AVAILABLE

STRIP METAL TINNERS LTD. Specialist tinners of metal strip in coil by a continuous Hot Dip Process. School Lane, Welling, Kent. Bex 1120. [8470

LET us quote you for metal spinnings in all metals up to 25 in. blank. Wades (Halifax) Ltd., Arden Works, Fenton Road, Halifax. [0022

PLANT FOR SALE

14" and 29"×72" Cluster Cold Rolling Mill by Bliss; drive from 200 h.p. slipring motors through David Brown reduction gearbox.

30"×36" Two-High Reversing Mill by Davy United, with 500 h.p. drive.

500 TON Horizontal Extrusion Press, suitable for billets 5" diameter.

SCALPING Machine by Kendall & Gent, suitable for billets up to 30"×36".

ROLLING Mill Drive 200 h.p. Met Vick motor with double helical reduction gearbox, 725-105 r.p.m.

H. E. REED (ENGINEERING) LTD.,
OAST WORKS,
MILL STREET, EAST MALLING, KENT.
Tel. West Malling 2489. [8495

ONE Shell Moulding Machine by Fairbairn Lawson Combe Barbour Ltd., complete with sand mixer. All in perfect condition.

TWO 200 lb. lift-out coke-fired Monolithic Furnaces, in really good condition; with eight sets of firebars, five 200 lb. G.M. Morgan Crucibles (Salamander), all unused.

OFFERS Phone Bolton 21041. [8493

12"×20" Schmitz heavy-duty two-high cold rolling strip mill; vernier motorized screw-down; water-cooled roll bearings and rolls. Complete unit on bed plate, 70 h.p. motor, strip coiling gear, spare rolls, etc. In excellent condition. Box 4412, c/o Metal Industry. [8491

SCRAP METAL (SALE & WANTED)

URGENTLY REQUIRED
ZINC BASE ALLOY SCRAP
clean or contaminated
TURNINGS AND SKIMMINGS
MITCHAM SMELTERS LTD.
REDHOUSE ROAD,
MITCHAM ROAD,
CROYDON, SURREY. [0008

NICKEL and High Nickel Content Scrap wanted. "Nimonics"; "Inconel", "Monel", etc. Offer for best prices to Nicholson & Rhodes Ltd., Princess St., Sheffield, 4. Phone 27491. [0011

B. J. PERRY & CO. LTD.
Exchange Buildings, Birmingham, 2
for Phosphor Bronze Swarf and Scrap
and all Non-Ferrous Metals.
Tel.: Midland 5986-7. [0113

TIME RECORDERS

FACTORY Time Recorders. Rental Service. Phone Hop. 2239. Time Recorder Supply and Maintenance Co. Ltd., 157-159 Borough High Street, S.E.1. [0014

BOOKS

METALLURGICAL Progress, 2 & 3. One of the most time-consuming tasks for the more advanced metallurgical student and research worker is "searching the literature". In these critical review, members of the staff of The Royal Technical College, Glasgow, not only review the existing work to date, but also discuss its relative value, so making their survey infinitely more valuable. As in the second series of critical reviews, the third volume presents a reasoned survey of the current state of research knowledge on various aspects of metallurgy. Seven articles by leading authorities present the information in concise, easily readable form. Series II 4s. 6d., Series III 6s. post free. From all booksellers or from Iliffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1.

MATERIAL Handling in Works Stores. 2nd Edition. By L. J. Hoefkens. Shows how the use of fork-lift trucks and pallets in industrial stores can increase production, utilize floor space more effectively, help control of movement and reduce costs. Includes a description of a system actually operated in a modern factory. 18s. net from all booksellers. By post 19s. from Iliffe Books Ltd., Dorset House, Stamford Street, London, S.E.1.

BOOKS

STEELS in Modern Industry. A Comprehensive Survey by 29 Specialist Contributors. General Editor W. E. Benbow. An invaluable guide for engineers, designers and draughtsmen; it specifies the steels best used in various engineering applications (bearing in mind the present need for economy), describes their general and special properties and characteristics, and how they may be surface finished for anti-corrosive and other purposes. 42s. net from all booksellers. By post 43s. 9d. from Iliffe Books Ltd., Dorset House, Stamford Street, London, S.E.1.

COST Accounting and the Engineer. By Kenneth B. Mitchel, A.C.W.A., AFF.I.W.M. This book sets out to explain cost accounting and how it operates to the engineer on the shop floor. The reader is shown in a practical manner how modern cost accounting influences every department in the works. 10s. 6d. net from all booksellers. By post 11s. 2d. from Iliffe Books Ltd., Dorset House, Stamford Street, London, S.E.1.

METALS and Alloys. Fifth Edition. This book contains approximately 4,600 compositions of non-ferrous alloy. It is mainly a list of alloys having definite names, including proprietary alloys, and it is indispensable to users of non-ferrous metals and alloys in any industry. 15s. net from all booksellers. By post 16s. from Iliffe Books Ltd., Dorset House, Stamford Street, London, S.E.1.

SAFETY in Industry. An introduction to the protection of personnel. By D. I. Macfarlane. A reprint from "Machine Shop Magazine" on the care of workers' health and safety in industry. Subjects covered include protection of the eyes and skin; precautions against ionizing radiations; press guards; dangers of rotating machinery; protective clothing; dust and fume control; flooring and lighting. 7s. 6d. net from all booksellers. By post 8s. 1d. from Iliffe Books Ltd., Dorset House, Stamford Street, London, S.E.1.

HIGH Productivity in Heavy Engineering. Production, inspection and cost control in welded fabrication. By A. G. Thompson, B.Sc., A.M.I.C.E., M.I.E.S., A.M.I.W. This book deals with the welding and fabrication of heavy plate material and rolled and extruded sections for uses ranging from nuclear reactors, ships, engine frames and structures to storage containers and pressure vessels. A close study is made of the latest types of metal-working and forming equipment; while the layout and organization of modern fabrication shops, handling methods, the use of electronic computers and data-control methods for oxygen-cutting, welding, quality control and non-destructive testing are also discussed. The author brings a refreshingly new approach to the vital questions of work measurements and costing in relation to productivity and efficiency. Managements and engineers will find a study of the methods discussed of considerable practical value in improving efficiency and in reducing costs. 65s. net from all booksellers. By post 66s. 3d. from Iliffe Books Ltd., Dorset House, Stamford Street, London, S.E.1.

CLASSIFIED ADVERTISEMENTS

Use this Form for your Sales and Wants

To "Metal Industry" Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1. Waterloo 3333

PLEASE INSERT THE ADVERTISEMENT INDICATED ON FORM BELOW

- **RATE: 5d. PER WORD, MINIMUM 5/-**
  Name and address to be included in charge if used in advertisement.
- **SEMI-DISPLAY: 27/6 PER INCH.**
- **BOX NUMBERS: If required 3/1 extra.**
- **PRESS DAY: 1st POST FRIDAY, for following Friday's issue.**
  Cheques, etc. payable to "Metal Industry" and crossed "& Co."

NAME .....

ADDRESS .....

			REMITTANCE VALUE.....	ENCLOSED

Please write in block letters with ball pen or pencil

NUMBER OF INSERTIONS.....

INDEX TO ADVERTISEMENTS

	Page
AEI-Birlec Ltd.	6
Aluminium Bronze Co. Ltd.	10
Associated Pressings Ltd.	11
Aston Tubes (Non-Ferrous) Ltd.	14
Auto Aero Ltd.	*Inside back cover*
Barnett Ltd., H.	12
Bolton & Sons Ltd., Thomas	11
Brightside Plating Co. Ltd.	5
Brock Metal Co. Ltd., The	*Inside back cover*
Brooks & Co. (Metals) Ltd., T. J.	14
Brookside Metal Co. Ltd.	10
Camelinat & Co. Ltd., E.	*Inside front cover*
Canning & Co. Ltd., W.	*Inside front cover*
City Casting & Metal Co. Ltd.	*Inside back cover*
Consolidated Zinc Corporation (Sales) Ltd.	8
Deutch & Brenner Ltd.	10
Entores Ltd.	16
Eyre Smelting Co. Ltd., The	12
Firma-Chrome Plating Co. Ltd., The	4
Frost Ltd., N. T.	16
Garnham & Sons Ltd., J. B.	9
Great Bridge Foundry Co. Ltd.	9
Hall Street Metal Rolling Co. Ltd.	14
Harris Plating Works Ltd.	4
Ilfar Aluminium Co. Ltd.	4
International Refining Co. Ltd.	*Inside front cover*
Joseph & Sons Ltd., M.	14
Magnesium Elektron Ltd.	9
McGhee (Metals) Ltd., Hugo	16
Maybank (Metals) Ltd., J. & J.	13
Metal Distributors (U.K.) Ltd.	12
Nickel Anodes & Non-Ferreous Castings Ltd.	3
Park & Paterson Ltd	1
Platt Metals Ltd.	*Outside front cover*
Rhondda Metal Co. Ltd.	11
Robertson & Co. Ltd., W. H. A.	2
Simpson (Assayer) Ltd., Gordon	4
Sklenar Furnaces Ltd.	*Outside back cover*
Stuart (London) Ltd., Robert	4
Threadgill Electro Deposits Ltd.	12
Williams Brothers & Piggott Ltd.	*Inside back cover*
Wolverhampton Trading & Scrap Co. Ltd.	4
Yorkshire Engineering Supplies Ltd.	14
Young Ltd., T. W.	13

N.T. FROST LTD
HARFORD ST., B'HAM 19

ELECTROPLATERS

The Specialist Electroplaters of Small Work in Quantities

FULLY APPROVED A.I.D. ALL FINISHES

TEL: CEN 4135 (6 LINES)

WE ARE NEITHER . . .
SAINTS NOR *SINNERS!*
BUT WE DO PAY
THE BEST PRICES
FOR . . .
NICKEL CONTENT SCRAPS

PURE NICKEL
NIMONICS
MONELS
CUPRO/NICKELS
NICKEL/CHROME
HIGH SPEED
TUNGSTEN

HUGO McGHEE
(METALS) LTD.
Westgate, Linley Lodge, ALDRIDGE, Staffs.
Phone: ALDRIDGE 53237/8

ENTORES LIMITED

ORES, METALS *and* RESIDUES

City Wall House, 14-24 Finsbury Street, LONDON, E.C.2.
Phone: MONarch 6050
Cables: ENTORES, LONDON
Telex No. LONDON 28455

SAFETY IN INDUSTRY

By D. I. Macfarlane, and illustrated with over 70 photographs, this book deals with protection of the eyes and skin; precautions against ionising radiations; press guards; dangers of rotating machinery; protective clothing; dust and fume control; flooring and lighting.

8¼" × 5½" 80 pp. Illustrated **7s. 6d. net** By Post 8s. 1d.

Obtainable from booksellers. Published by:—
ILIFFE Books Ltd Dorset House Stamford St London SE1

Printed in Great Britain by James Cond Ltd., Charlotte St., Birmingham 3. Published by Iliffe Production Publications Ltd., Dorset House, Stamford St., London, S.E.1

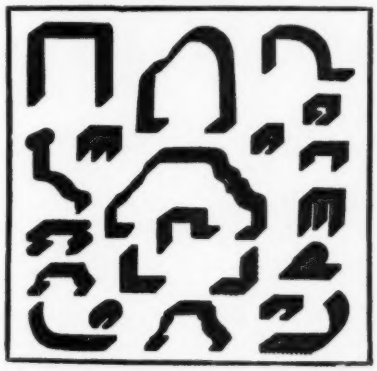
NON-FERROUS

GUNMETAL
PHOSPHOR BRONZE
MANGANESE BRONZE
LEAD BRONZE
SILICON BRONZE
ALUMINIUM BRONZE
BRASS
NICKEL SILVER
BRAZING METAL
Also SELECTED SCRAP METALS
A.I.D. & ADMIRALTY APPROVED

THE CITY CASTING & METAL CO., LTD.
BARFORD ST., BIRMINGHAM, 5
Telegraphic Address: "Turnings" Birmingham
Telephone: Midland 0645

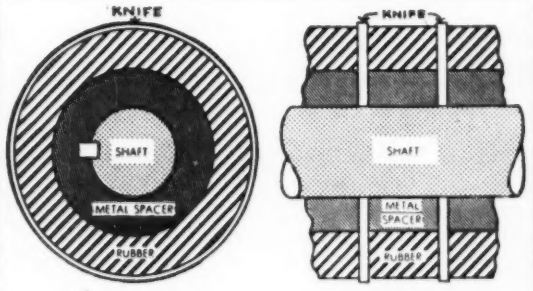
INGOTS
SINCE 1888

TUBES
SEAMLESS & BRAZED
IN
BRASS, COPPER, WHITE METAL, &c.
LOCOMOTIVE, MARINE & CONDENSER TUBES
STEAM, HOT WATER, REFRIGERATOR AND GENERAL ENGINEERING TUBES.



OVER 1,500 DESIGNS OF SECTIONAL TUBES MOULDINGS AND BEADINGS

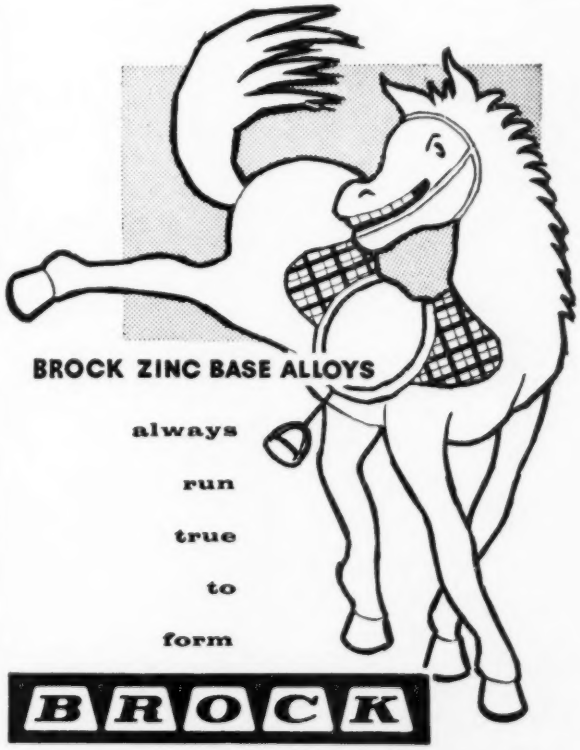
WILLIAMS BROTHERS & PIGGOTT, Ltd.
SMALL HEATH, BIRMINGHAM
Telegrams: "Tubes, Birmingham." Tel.: Victoria 0155 & 2111



ARTUS
SYNTHETIC RUBBER STRIPPERS
Patent No. 784449
FOR SLITTING MACHINES

ARTUS PLASTIC SPACERS
PRECISION PLASTIC SHIMS
FROM ·0005" UP TO ·040"
"THE COLOUR TELLS THE THICKNESS"

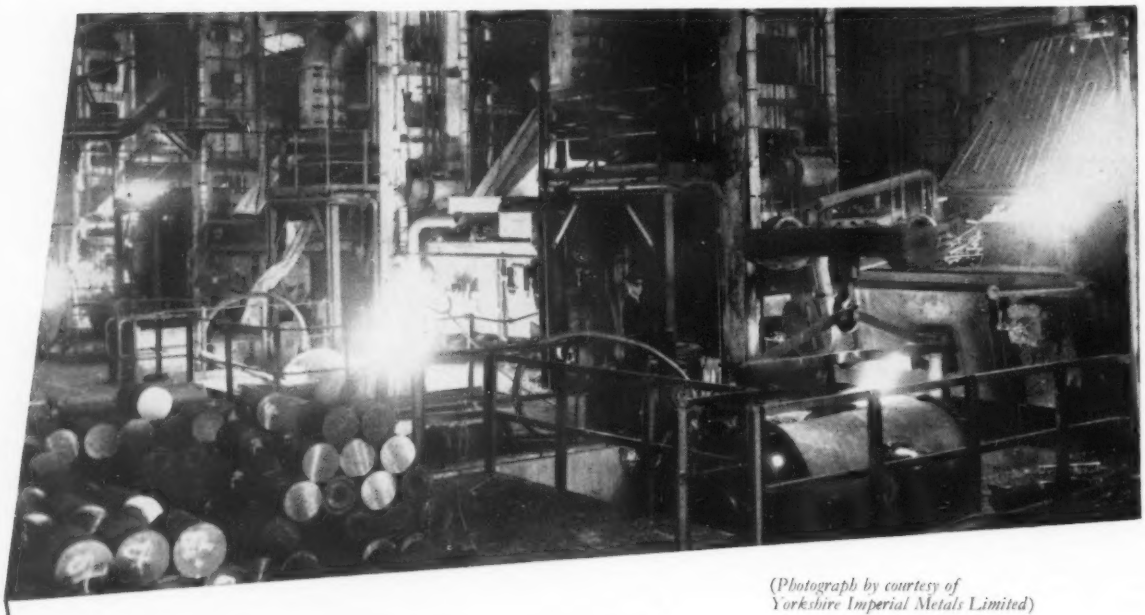
AUTO AERO LTD
44 PACKINGTON ROAD, LONDON W.3
Acorn 0544



BROCK ZINC BASE ALLOYS
always run true to form
BROCK
METAL COMPANY LIMITED
BADGER WORKS, SALTLEY ROAD, BIRMINGHAM, 7.
TEL: ASTON CROSS 1351-2

Hall-mark of fine silver in 1664

Yorkshire Imperial Metals Limited, Kirkby, Liverpool use SKLENAR furnaces for the production of copper billets. The illustration shows four five-ton furnaces in which melting and refining take place.



(Photograph by courtesy of Yorkshire Imperial Metals Limited)

SKLENAR

mark of the efficient melting furnace today

Any SKLENAR furnace can melt a charge of copper (5 lbs. or 5 tons) in 40 minutes. *And there is no crucible to renew.*

PROVE IT IN YOUR OWN FOUNDRY
with our 14-day free demonstration offer in the U.K.

Write for free booklet "efficiency in melting"

SKLENAR FURNACES LTD
385 NEWPORT ROAD CARDIFF
Telephone: CARDIFF 35645/7 CABLES: SKLENAR CARDIFF

P5814